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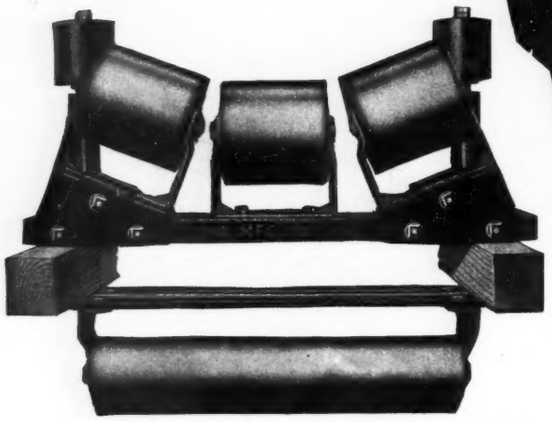

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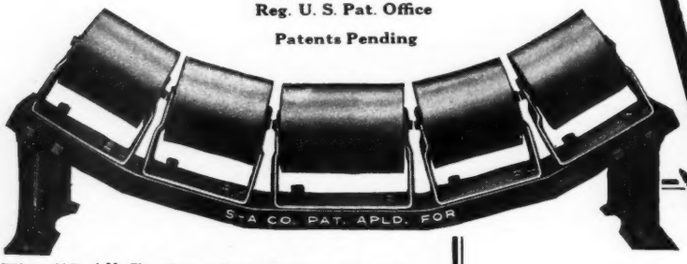

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Engineering and Mining Journal

VOLUME 102 NOVEMBER 4, 1916 NUMBER 19

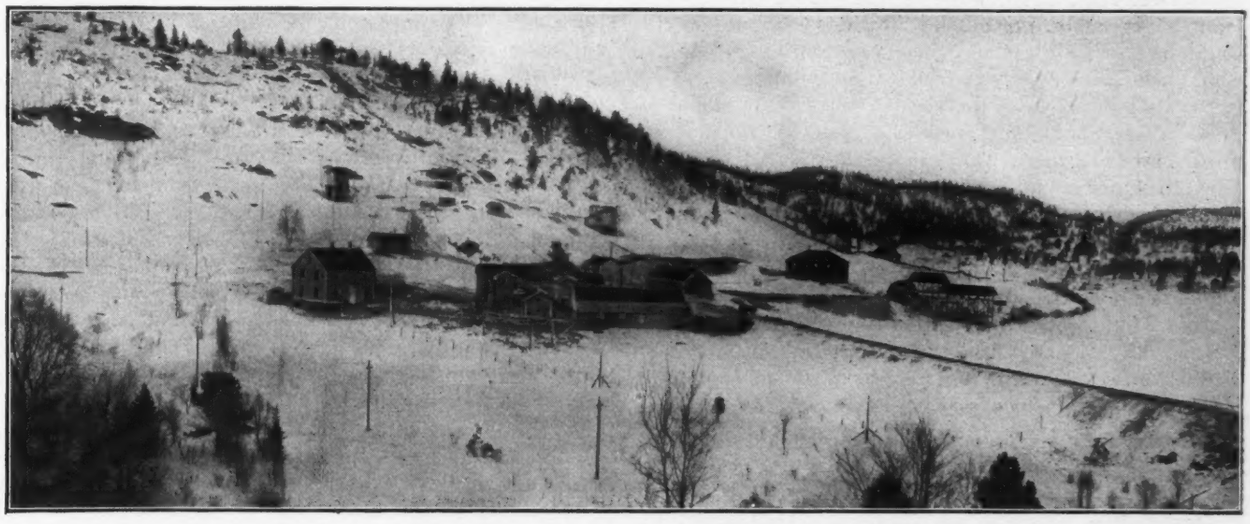
Sinking the Wallenberg Shaft

By Lloyd D. Cooper*

SYNOPSIS—The sinking of a 1,200-ft. shaft in Norway by an American contractor is described, together with the equipment used and the progress made. An actual sinking speed of 85 ft. per month was attained. The shaft is situated a mile from the Lökken plant of the Orkla company and will increase the annual production from 150,000 to 1,000,000 tons.

The Orkla Grube-Aktiebolag, which operates the Lökken mine, was organized under the laws of Norway in 1904, the stock control being in the hands of Norwegian and Swedish interests. The mine is connected with Thamshavn, at the head of the Orkedalsfjord, by an electric railway 16 mi. long. At Thamshavn the company owns wharves for passenger and freight traffic and automatic loading equipment. It also owns a fleet of ore boats and a passenger steamer making two round trips daily between Thamshavn and Trondhjem, a distance of about 20 mi.

The present production of the mine is in the neighborhood of 150,000 tons of cupriferous pyrite annually. A systematic drilling campaign was carried on which resulted in establishing a large tonnage of ore. The annual production is planned to be increased to 1,000,000 tons. To develop and mine this recently found addition to the ore reserves, it was deemed advisable to sink a shaft 1,200 ft. deep about a mile distant from the present surface plant of the Lökken mine. The work was started by the Orkla company and the shaft sunk 85 ft. As the shaft occupies a hillside position, a tunnel was driven out to surface 65 ft. below the collar. This was used for tramming out the spoil, the shaft collar being used in lieu of a headframe.



A GENERAL VIEW IN THE VICINITY OF THE WALLENBERG SHAFT, ONE MILE FROM THE SURFACE PLANT OF THE ORKLA COMPANY

The Work Undertaken by Contract

In May, 1915, the E. J. Longyear Co., of Minneapolis, entered into a contract with the Orkla company to finish sinking the shaft to a depth of about 1,200 ft. Under this contract it was agreed to maintain an average rate of 66 ft. (20 m.) per month. The crew for the work was secured on the Marquette and Menominee ranges in Michigan and reached Lökkens Verk early in July, 1915. Shaft sinking, however, was not started until Aug. 5.

The Orkla company had installed a surface plant for the shaft-sinking operations. This consisted of one motor-driven Ingersoll two-stage air compressor, one motor-driven Hammer single-stage air compressor, two motor-driven hoisting engines having a hoisting speed of 300 ft. per min., and a 7½-hp. Sturtevant ventilating fan. This equipment was used by the Longyear company in the consummation of its contract with the addition of a No. 5 Leyner drill sharpener, which was brought over from America. The drilling equipment consists of 15 BCR430 jackhamers with 30 sets of ⅞-in. form-point steel.

*Formerly chief engineer; now manager for E. J. Longyear Co. at Trondhjem, Norway.

The shaft is 12x18 ft. outside of timbers, divided into five compartments which will provide for two skips, two cages and the necessary pipes and ladderways. The rock through which the shaft has been sunk is known as gabbro. It drills easily except through seams of low-grade ore, which occur frequently.

Temporary sheaves are supported on timbers set in the concrete foundations for the shafthouse, which itself will be built of reinforced concrete, as well as the machine shop and engine house which are at present under construction. The spoil is hoisted in two 30-cu.ft. buckets, guided by crossheads and is used for filling a railroad grade about 1,000 ft. from the shaft.

The water encountered is handled by one Eureka 10x4½x10-in. outside-packed plunger pump on the 200-m. level and one 7x3-in. piston pump which is carried down on the timbers as the shaft is sunk. A small pump is used in the bottom, and all pumps are driven by air. A large sump on the 200-m. level was made by building a concrete wall across the drift, and most of the water that comes into the shaft above this level is caught by it. It was planned to pump from the 200-m. level with an electrically driven vertical centrifugal pump capable of handling 135 gal. per min. to a height of 650 ft., but this was found unsuitable and was replaced by an air pump.

The air compressors were of sufficient capacity to maintain 90 lb. pressure, but an unusually early winter caused a serious shortage of water at the power plant just at the time when it became necessary to pump with air, so that from December, 1915, until March, 1916, pressures of from 55 to 80 lb. prevailed. At times only four drills could be used while the pumps were running. As the depth from which the water had to be pumped increased, it was found necessary to run an air line to the compressors at the Lökken mine and use additional compressed air from there. The air line in the shaft is a 4-in. pipe, to which is attached a header with twelve ¾-in. nipples for the machine and pump-hose connections.

The work has been carried on in three 8-hr. shifts with an average for the year of 8.5 men per shift. The personnel is under the supervision of a mining captain and consists of the following men working an 8-hr. shift: 3 foremen, 30 miners, 1 timber foreman and 4 timbermen. The following worked a 10-hr. shift: 2 timber framers, 2 blacksmiths, 2 pipemen and 1 electrician. In addition, the following worked a 12-hr. shift: 2 pumpmen, 3 hoisting engineers, 2 compressor men and 9 landers.

The Method of Working

The first 260 ft. of the shaft was supported with round timbers spaced 7 ft. apart without lining. Soft ground was encountered which made it necessary to change the method of timbering and 7x7-ft. square sets, spaced 6 ft. on center and supported on timber bearings at 100-ft. intervals have been used. The shaft is lined with 3-in. plank, and the skip roads are separated from the rest of the shaft with 3-in. matched lumber. All timbering, with the exception of putting in the stringers, is done without interfering with the sinking operations.

A strong timber stage, having doors through which the buckets pass, is hung below the bottom set, and on this the timbermen work. This stage is supported by four wire cables wound on hand winches in the tunnel and is lowered as the stage is sunk. The skip-roads are covered at the tunnel level by two pairs of doors, balanced with counterweights, which are closed after the bucket is hoisted, preventing any rock from falling back into the shaft.

Under the usual arrangement of drilling, which of course was varied somewhat as the character of the ground changed, 14 sink holes were drilled and with them were blasted the four corner holes from the last round above, using du Pont delay electric exploders. After the rock from this blast had been hoisted, 46 squaring-up holes were drilled, the inside holes being started down in the sink. The holes were found to break deeper when drilled in this way, and it more than compensated for the extra time taken in drilling the round in two parts. On the second blast 15 to 20 holes were shot and the mucking continued until water appeared in the bottom of the shaft. The remaining holes, with the exception of the four corner ones, were then blasted so that the pump was not taken down until after the last blast.

After blasting, the smoke was drawn out through a 10-in. pipe. This method required from 30 to 40 min. to clear the shaft so that work could be resumed.

The Rate of Progress

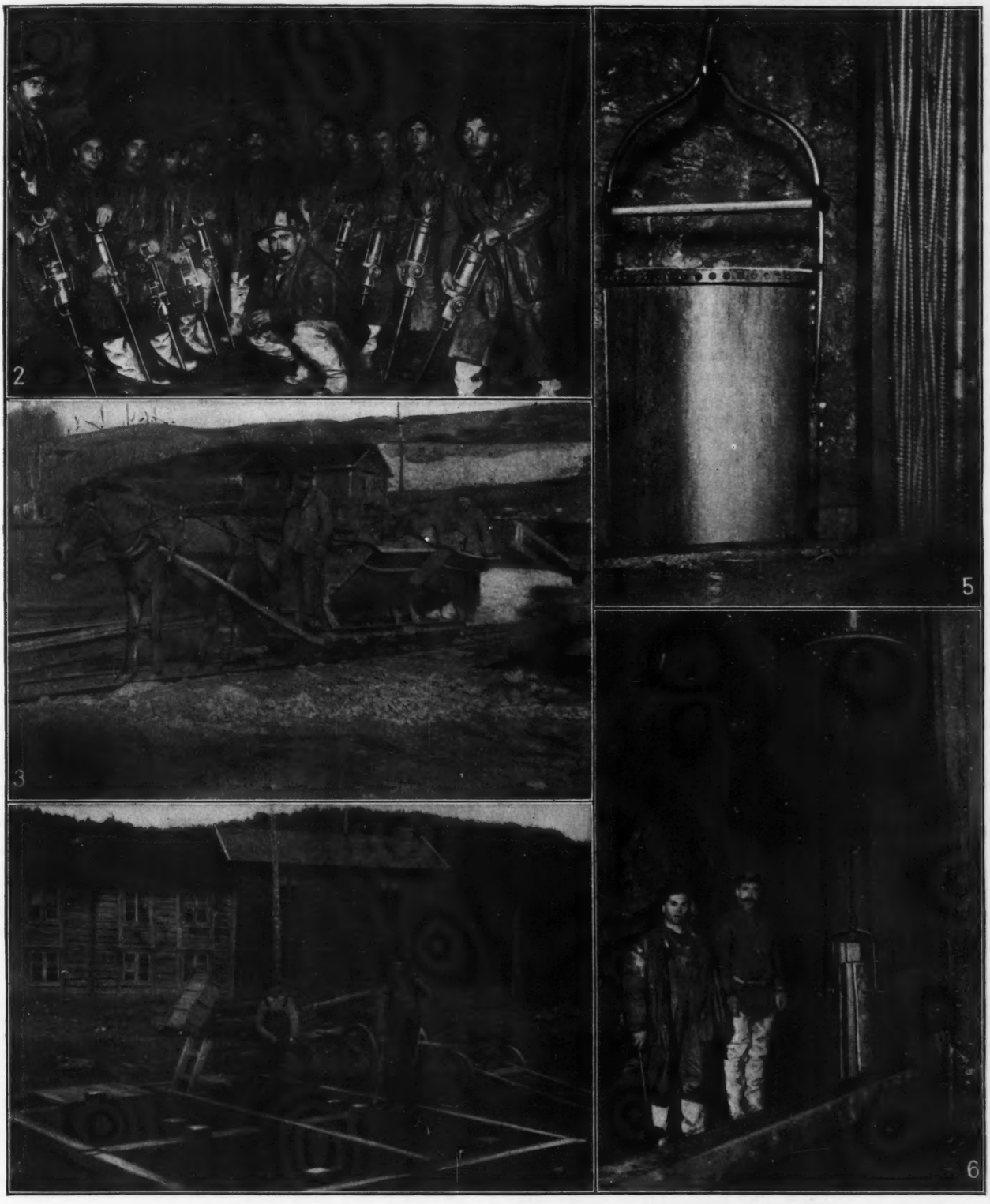
During the year of sinking from Aug. 5, 1915, to Aug. 4, 1916, the cuts averaged 5.7 ft. in depth, breaking 1,231 cu.ft. of rock each with 494 lin.ft. of drilling. The average drilling speed was 4.4 ft. per machine-hour, which includes all the time from the completion of the mucking until starting to charge the holes. The 14 sink holes are frequently drilled by 10 machines in one hour. The holes averaged 7.6 ft. in depth. Of the actual working time in the shaft, 30% was spent in drilling, 59% in mucking and hoisting and 11% in blasting.

During this period the miners worked 7,217 shifts removing 206,496 cu.ft. of rock, or 28.6 cu.ft. per man per shift. In this time the shaft was sunk 904 ft., or at the rate of 75.3 ft. per month. As the shaft had previously been sunk 85 ft. by the Orkla company, the total depth on Aug. 4, 1916, was 989 ft. In connection with the sinking stations were cut at the 200-m. and 300-m. levels, requiring 49 shifts of 8 hr. each; in October, 1915, the compressor house was destroyed by fire, causing a loss of 38 shifts, while labor troubles in May and June delayed the work 30 shifts. The actual sinking time (making no allowance for delays was therefore 276 days, or a sinking rate of 85.3 ft. per month.

As the Norwegian laws prohibit Sunday work, requiring a suspension of 28 hr., no work was done from 6 p.m. on Saturdays until 10 p.m. on Sundays. In the spring of 1916, however, permission was obtained to work until 11 p.m. Saturdays, thus permitting all the men to work six full shifts a week.

At the date of writing (Aug. 22, 1916) there still remained approximately 210 ft. of shaft to be sunk and two stations to be cut.

The following permanent equipment is to be installed when the shaft is completed: Two 500-hp. hammer air compressors, direct-connected to 300-kw. motors (each compressor will have a capacity of 2,600 cu.ft. per min.); one hoisting engine for men and materials, having a 10-ft. drum with a speed of 1,200 ft. per min. and driven by a 280-hp. motor; one hoisting engine operating two 5-ton skips at a maximum speed of 1,450 ft. per min. and driven by a 700-hp. motor. (Both hoists will have automatic speed-regulating devices attached to the indicators to prevent overwinding or excessive speed at the start); one



DETAILS IN THE WORK OF SINKING THE WALLENBERG SHAFT

Fig. 2—A round of jackhamers used in drilling the holes. Under proper air pressure, 14 sink holes were frequently drilled by 10 machines in an hour. An average drilling speed of 4.4 ft. per machine-hour was maintained. Fig. 3—Tramming out the waste from the mouth of the tunnel. A tunnel 65 ft. below the collar of the shaft serves as an exit for the spoil, which removes the necessity of a headframe, the collar supporting the sheaves. Fig. 4—Framing a set of shaft timbers. The timbers are framed on the surface and then lowered as shown in Fig. 6. A set is made up of 7x7-ft. square sets spaced 6 ft. apart in soft ground. Fig. 5—The 30-cu.ft. bucket used to hoist the rock to the tunnel level. These are guided by crossheads. Fig. 6—The method of lowering the timber after it is framed. A hole is drilled through the ends of several timbers and these are bolted to a yoke suspended under the bucket

electrically driven plunger pump handling 135 gal. of water per min. to a height of 1,200 ft.; one 30-hp. ventilating fan; two 36x42 Buchanan rock crushers, which will be installed underground.

Austrian Mining in Serbia

On the theory that even one's worst enemies should have their merits recognized, the *Echo des Mines et de la Metallurgie,* Paris, credits the Central Powers with rapidly organizing the underground work in Serbia. Under the general military government of Austria was created a section of mines, which has been prospecting the mountains of Serbia. A laboratory was established at Belgrade. This mining section is headed by a captain, Dr. Kern; its technical manager is Lieutenant Imhoff, director of mines; its working inspector is Lieutenant Franz, mining engineer. The scientific, chemical and metallurgical researches are directed by Lieutenant Brunn.

Prospecting began in November, 1915, in charge of Lieutenants Imhoff and Burkhart, of the Hungarian Finance Department. It is now considered as finished, and seven mines are to be exploited.

In the vicinity of Chabatz the mines of Dorspotok, near Krupanj, property of the Austro-Hungarian railways, are worked for antimony. At Rudnik the military authorities are taking out lead and copper. In the neighborhood of Belgrade the mines of Cavoni Breg (mining district of Ripanj) will soon yield lead, but the most important lead mine worked by the military authorities is that of Babé, whence is derived daily a car of lead and 100 cars of ore which is treated in the works of the interior. To work this mine it has been necessary to build a narrow-gage railway over 5 mi. long, spanning six deep gorges. Considerable labor and expense were required, but the scarcity of lead could thus be relieved.

To obtain copper, the mines of Majdanpeck have been worked. The daily production has been three cars of copper and 200 cars of pyrite.

At Vlaskopolje may be extracted, for supply of Belgrade, 30 cars per day of coal, poor but usable. In the valley of Ibar, near Usce, coal measures have been found. If they are exploitable, they will be used on the military railroads, but it will be necessary to build about 4 mi. of railway to work them.

Strontium in Arizona

That minerals of strontium are found in quantity in Arizona is a fact that is not generally known, according to a bulletin of the Arizona State Bureau of Mines. Fifteen miles south of Gila Bend, in Maricopa County, strontium, as celestite, occurs in the sedimentary series, associated with gypsum, sandstone and conglomerate. The most promising beds are 40 to 50 ft. thick and are most productive in the upper 10 ft. There are undoubtedly other discovered deposits of strontium salts within the state, but they are not recorded.

Strontium is not easily recognized at sight, but is readily identified by the simple tests that are outlined in bulletin No. 35 of the Arizona State Bureau of Mines, entitled "Celestite and Strontianite," which may be secured from Charles F. Willis, director, Arizona State Bureau of Mines, Tucson, Ariz. There are several uses for strontium salts, the principal ones being in the sugar industry and in the manufacture of fireworks.

Diamonds of Smiths Flat

By Burr Evans*

It is not generally known that 47 or more genuine diamonds have been found in the Tertiary gravels that lie embedded in the old channels of the lava-capped buried rivers of the Neocene river system, in and about Smiths Flat, Eldorado County, California. Judge William Pitt Carpender, an old-time miner who arrived at Smiths Flat in 1854, from Akron, Ohio, via the Nicaragua route, operated a deep-gravel mine in the "Deep Blue Channel" on the flat for a number of years.[1] He was justice of the peace at Placerville, the county seat, for 32 years, and being interested in mining matters in general, he kept an accurate record of all the diamonds found in Eldorado County that he happened to hear about, making it a special point to obtain the facts as nearly correct as possible regarding each stone.

Following are Judge Carpender's notes of 33 stones found. First is the name of the person finding the stone, then the name of the mine or locality where found, the year when found, the size, color, weight (in Troy grains or carats), etc., and its disposition, when known:

John Bradshaw, Bunchanan Mine, Smiths Flat, 1859, one small white stone.

John Lyford, at Smiths Flat, 1865, one white stone, 3 grains, stolen by a woman and set rough in a ring.

A. Brooks, at Spanish Ravine, 1866, one white stone, 2 grains, flawed.

Ward Bros., near White Rock Cañon, 1867, three small stones, largest one valued at $50 in San Francisco.

Thomas Ward & Co., Live Oak mine, Reservoir Hill, 1868, three stones, two white of medium size, and one yellow; one set in a ring, in possession of Ashcroft, of Oakland, Calif.

Thomas Potts, Sr., near White Rock Cañon, 1868, one light-yellow stone, 2 grains, sold to A. W. Goodyear (first mineralogist of the State of California) when he visited the mines at Smiths Flat in 1871.

J. Jeffry, Webber Hill [no date], one yellow stone, 3 grains.

Mrs. Sam Henderson, Wisconsin Flat mine, 1868, one white, medium size.

Cruson & Olmstead, Wisconsin Flat mine, 1868, four stones.

Henry Olmstead, Wisconsin Flat mine, 1869, one stone, $\frac{9}{32}$ in. maximum diameter, weighed 5 $^{61}/_{100}$ grains, white coating on surface, sold for $280 in San Francisco.

McConnell & Reed, mine south side of Webber Hill and east side of Texas Hill, 1870, one stone, canary color, size of small white bean. (Mrs. Caleb Reed, of Placerville, now has stone set in a ring.)

Nathaniel O. Ames, mine on Webber Hill [no date], one stone of 4 grains, set in ring and worn by Shelly Inch, postmaster of Placerville for many years. (This stone is now in possession of L. P. Inch, city manager of a fire insurance company at 444 California St., San Francisco.)

Charles W. Schafer, Tolkey mine, Texas Hill [no date], one stone of 2½ grains, sold to John Cook.

Fred Bendfeldt, Sr., at Smiths Flat, 1878, one stone of $\frac{7}{16}$ carat, canary color, sold to W. F. Alma, of Boston. (Fred Bendfeldt arrived at Smiths Flat, from Hamburg, Germany, via the Horn, in 1853, and owned and operated the "Bendfeldt" deep-gravel mine at the Flat for thirty-odd years. He "crossed the line" on the Flat Feb. 4, 1916, at the age of 88 years.)

Ed Randall, Wisconson Flat mine, 1879, one white stone of ⅛ carat.

Fred Bendfeldt, Jr., at Smiths Flat, 1894, one white stone of $\frac{1}{16}$ carat, canary color, sold to W. F. Alma.

Bert Carpender (son of William Pitt Carpender), at Smiths Flat, 1896, two white stones of 1⅞ carats, and ¼ carat, and one canary-color stone of 1⅝ carats, sold to W. F. Alma.

Thomas Murdock, at Smiths Flat, 1896, one yellow stone of $1^3/_{64}$ carats, sold to W. F. Alma.

Snow Brothers, near Newtown, 1897, one white stone of 1½ carats.

Snow Brothers, near Fairplay, 1897, one canary-color stone of 3 grains, in possession of George Richardson.

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*Box 191, Placerville, Calif.

[1]Deceased Feb. 16, 1916, aged 85. See obituary in the "Journal" of Mar. 4, 1916, p. 450.

Bert Carpender, Stanley mine, Smiths Flat, 1899, one white stone of 2 grains, in possession of W. P. Stanley.

Fred Bosworth, in Cedar Ravine, at Placerville, 1900, one white stone of 4½ grains. (Bosworth still has this stone in the rough and has been offered various prices for it up to $80.)

J. Allen, in Cedar Ravine, at Placerville, 1901, one white stone of ⅛ carat, sold to W. F. Alma.

Bert Carpender, in Carpender mine, at Prospect Flat, 1912, one white stone of 3 grains.

The majority of the persons named in the foregoing list still reside in the County of Eldorado and will vouch for the correctness of the finds. Besides the persons named, there are a number of others who have personal knowledge of the various finds as stated; among whom can be mentioned Theodore Rupley, miner, who has been at Smiths Flat since 1853; Oliver E. Bailey, C. W. Martin, Louis N. Stricker, James R. Vandegrift and Clarke Howard, justice of the peace, all of Placerville, and a number of others.

In addition to the foregoing list of diamonds found, F. F. Barss, who arrived in Placerville from New York City via Panama in 1852 and started a jewelry store which he has conducted constantly ever since, showed me on Feb. 14, 1916, two diamonds which were found at Smiths Flat about 1874. One of about $\frac{1}{10}$ carat he bought from a Chinaman; and the other, which he bought from a miner, is a good white stone of over ⅛ carat. Mr. Barss states that in the 70's and 80's he mounted five stones in breast-pins and two in rings for different people, all of which were good diamonds and were found in the vicinity of Smiths Flat. One stone he remembers well because of its having a piece of the original blue-matrix attached to it. Another good stone, he states, was found about 1869 by Henry Ashcroft, who is now 85 years of age and is residing at Placerville, Idaho.

N. H. Burger, who arrived in Placerville in 1900 and has conducted a jewelry store there for a number of years past, states that from about 1906 to 1909 he had cut in New York City and set in rings five diamonds that were found by different persons in the gravel of the Neocene river channels between Placerville and Smiths Flat. The stones ranged from ⅛ to 1 carat, and one was a fine blue stone of about ⅜ carat; and in 1914 he set in a ring for Frank Jones, a miner, a good white diamond of about ½ carat, which Jones had found in his gravel mine in Chile Ravine, just south of Placerville, and which he still has.

Some day the pipe of blue matrix, from which these diamonds presumably came, may be discovered. This "pipe" undoubtedly has been worn down, eroded and disintegrated in the past ages, thus releasing these diamonds that have been found in the gravel of the buried ancient river channels that pass through Smiths Flat. It is reasonable to suppose that many more of these stones will be found from time to time, as there must have been quite a number more set free from the matrix of the "pipe" in which they were formed. This "pipe," wherever it may be, is evidently overcapped and buried under a mass of volcanic ash and lava which tops off the greatest part of the surrounding region. If this "pipe" is found near Smiths Flat, then the former active mining life, with greatly renewed vigor, will wake again this old-time camp.

A Spanish Mines Consolidation is scheduled to take place, according to "Madrid Cientifico," between two companies opearting lead and copper mines in the Province of Cordoba. The proposed plan involves the absorption of the Sociedad Los Almadenes by the Sociedad La Argentifera de Cordoba, with a corresponding increase in the capital stock of the latter.

Progress of First-Aid Work in British Columbia

SPECIAL CORRESPONDENCE

The experience in connection with efforts made to arouse general interest among metal miners in British Columbia in matters relating to instruction in first aid has not been as favorable thus far as could be desired. Nevertheless the officials directly charged with the duty of encouraging men engaged in and about metalliferous mines in the province to attend classes for instruction and to become competent to render first aid in cases of emergency are steadfastly persisting in this important and beneficent work. They are looking forward with confidence to increasingly good results as time passes and more of those who should be chiefly concerned come to a realization of the necessity rather than the mere desirability of taking upon themselves personally this duty to their fellow workers as well to themselves. Only recently was the report of the British Columbia Department of Mines for the calendar year 1915 published, which accounts for this apparently tardy reference to the information given by the department's instructor in first aid, Dudley Michell, of Victoria, of the results of his work during the year.

As Mr. Michell's report for 1915 covers only his second year's official work in giving attention to first aid and the use of mine-rescue apparatus, it may be of interest to first recall what he accomplished in 1914 and then briefly review what was done in 1915. It should be understood, though, that Mr. Michell is not generally called upon to instruct those who attend classes in first aid, that duty falling to duly qualified surgeons. The policy of the Department of Mines is to encourage men to endeavor to obtain first-aid certificates of competency, from a recognized ambulance association. This can be secured only by passing the examination under the auspices of such an association after the prescribed number of lectures, given by an approved surgeon instructor, shall have been attended. The requisite percentage of marks must be earned at an examination held by an authorized surgeon examiner.

WORK ACCOMPLISHED IN 1914

Mr. Michell entered upon his duties in May, 1914, and about the end of that month met several mine managers at a meeting of the Western Branch of the Canadian Mining Institute at Nelson, West Kootenay, and placed before them the proposed policy of the Department of Mines with the object of inducing miners to take first-aid instruction. Directly afterward he set about organizing St. John Ambulance Association "centers" and forming first-aid classes. The immediate result was that two classes were formed at Rossland, followed by three in Boundary district, and afterward by five in various parts of West Kootenay. Then the European War began, and as a result of the consequent demoralization of the markets for metals, many of the metalliferous mines were closed for the time and most of those who had been employed at them scattered far and wide. Rossland mines only, escaped the general disorganization, so that the first-aid work begun in that camp was continued without interruption, until today it is established with little likelihood of the larger mines there ever again being content to go along without having among the

mine employees a considerable number of men trained in first-aid or mine-rescue work, or both.

In the cases of the mines employing comparatively large numbers of men and having the services of a resident surgeon available for purposes of instruction, there was, in important instances, not much difficulty, but as Mr. Michell reported, "It has been proved that in the small mines situated long distances from town successful results are not obtained by an instructor, owing in most part to the large proportion of men employed at these mines being unable to properly speak and understand English, while the others do not seem to care to have their leisure hours taken up by instruction in first aid, especially in the only place they have for recreation—the bunkhouse.

It is noteworthy that during Mr. Michell's first year of office, 405 men attended first-aid instruction classes in Kootenay and Boundary districts and 76 in the Coast district, making a total of 481. These figures relate only to metalliferous mines. For 1915 Mr. Michell's report included the following: "More than 700 miners attended first-aid lectures at the various mines of the province. The net results show that 301 men (from coal mines 242 and from metal mines 59) passed a final examination in first-aid work and were awarded various grades of certificates by the St. John Ambulance Association. The actual number of men finishing this course may be placed at 450. The difference between the total number attending the lectures and the number passing final examinations is due to various causes, some of which are: Failure to pass examinations, class completing lectures but not examined, class disbanded, and lack of interest; all of which causes have unfavorably affected results. I regret to say that the results obtained from the metal mines are not as good as were to be expected."

Progress in 1915 in Different Camp

Classes were conducted in coal-mining districts of Crowsnest, in Southeast Kootenay, Nicola Valley, and Vancouver Island, and in metal-mining camps at Kimberley, East Kootenay; Rossland, West Kootenay; Greenwood, Boundary; and Van Anda, Texada Island. Mr. Michell reported, further: "The largest number of men trained in first aid in one year and at one company's mines was at the mines of the Crow's Nest Pass Coal Co., where 139 passed first-aid examinations. This number shows approximately one trained man for every 14 persons employed above and below ground at those mines, which result is highly satisfactory for one year's undertaking. All the classes were taught and examined by duly qualified medical practitioners and were conducted in accordance with the prescribed rules of the St. John Ambulance Association. At the Le Roi gold-copper mine, Rossland, a most systematic method of training was adopted. The afternoon shift was divided into three sections; each section reported at the mine once a week, an hour before the shift commenced, and received practical instruction, by a trained first-aid man, in the work of bandaging, etc. There has also been established at this mine a safety department, a safety committee and a safety engineer; their duties are the systematic inspection of the mine and the headworks with regard to safety, encouragement of first-aid instruction, and 'safety first' teachings.

It may be added that this year interest in first-aid work is being well maintained at the Consolidated Mining and Smelting Co.'s Centre Star and Le Roi mines, Rossland; attention is being given to it at the Britannia Mining and Smelting Co.'s copper mines in Vancouver mining division, Coast district; and a mine safety committee has been organized and is doing good work, including arranging for giving instruction in first aid, at the Granby Consolidated Co.'s Hidden Creek copper mines near Observatory Inlet, also in the Coast district.

Works of American Zinc and Chemical Co. at Langeloth

The property of the American Zinc and Chemical Co. at Langeloth, Penn., according to a recent bulletin of the Engineers Society of Western Pennsylvania, embraces 900 acres, 200 of which are in the townsite and 100 acres in the present plant, consisting of about 30 buildings. Besides this there is a coal mine of 2,500 acres having a daily capacity of 1,500 tons, which will soon be increased to 2,500 tons daily.

There are 15 ore bins having a capacity of 2,000 tons each. The orehouse is equipped with a heavy electric traveling crane. The crushing mill, which consists of a drier, crushing rolls and screens, has a daily capacity of 200 tons of ore.

The four Hegeler roasting furnaces, each 80 ft. long, having a capacity of 50 tons of raw ore, have 14 ore hearths. Six of them are fired by Hegeler gas producers. Heat in the remaining eight is furnished by the burning of the sulphur in the ore.

The sulphuric-acid plant uses the chamber process, there being four systems of lead chambers in which 2,500 tons of sheet lead is used. Nitric acid and zinc-sulphate plants are under construction.

The distillation furnaces are of the Hegeler-type, seven blocks being in operation and one under construction. Each block contains 912 retorts. Four blocks are heated by a new type of Wood mechanical producer, each using 3,000 lb. of coal per hour. The three remaining blocks are heated by Hegeler gas producers.

In the mixing plant the ore, reducing material and coal for charging the retorts are mixed in two 80-cu.ft. mixers. The retorts, condensers and other fireclay shapes are made in an uptodate pottery.

A small zinc-dust furnace is now operating, but will soon be replaced by a large furnace in which both zinc-dust and sherardizing zinc will be produced. The zinc-oxide plant is now being built.

The power plant contains two 2,000-kw. Curtis horizontal turbines driving General Electric generators. The boiler plant consists of four 588-hp. and three 529-hp. Rust boilers using waste heat from the smelting furnaces. Four additional boilers are in the course of construction.

The company has built the modern industrial town of Langeloth. A sanitary sewer system is being built. Over 200 houses are now occupied, and 100 more are being built. These houses can be purchased by the workmen on easy terms. The school, which cost $25,000, will be run on the Gary plan.

A New Gold Discovery in Tasmania is reported near Waratah in Russell County. This locality is not far distant from the Mount Bischoff tin mines. The American consular representative is quoted as believing that the recent strike may create a demand for mining machinery.

Improved Magnetic Separator

By August F. Jobke*

SYNOPSIS—An improvement of magnetic-separation work is claimed for the Jobke machine, which utilizes several magnetic zones in a given field, all of the same length of air gap. It is declared that time is not a factor influencing the rapidity of magnetizing ore particles, and the overshooting of a magnetic zone by a particle must be attributed to inertia and not to slowness of magnetic action.

Since the introduction of the invention of J. P. Wetherill, U. S. patent 555,792, which concentrates the magnetic field between opposing poles of wedge form, this style has been found the most effective for the purpose of concentrating ores, especially those of low permeability. Before this invention the shape of magnet poles was not altogether wrongly defined, since the action of corners or edges of flat poles was the factor that made separation possible, whereas an evenly distributed field does not attract fine particles. This fact can easily be demonstrated in a field between flat poles, where the particles to be attracted tend to cling to the outside edges. In order effectively to attract magnetic particles to a pole, it must have a wedge-shaped edge opposite another pole, to form a diverging field so that the particle during attraction may enter a field of increasing intensity, thereby encountering a concentration of more lines of force as it proceeds on its way.

Opposing cylindrical poles show a similar tendency to converge the field toward their surface in a degree depending on their curvature, the smaller the curvature, thereby approximating the wedge shape, the stronger the convergence and the attractive force.

The best form of field which has the advantage of a small reluctance is that made by an upper wedge-shaped pole and a lower flat pole. This field converges toward the upper pole, toward which alone the attraction takes place. With a practical length of air gap, the field converges right from the face of the lower pole, so that the ore particle is bound to move toward the upper pole, even if it rests on the face of the lower. This latter form is therefore the one used in modern magnetic separators.

Number of Fields Regulated by Ore Components

Where the separation of different components in complex ores is sought, as many different fields of varying strengths are required as there are components, and each must correspond in strength to the permeability of the individual component in order to effect a perfect separation.

When the concentration of a single ore is desired, a single field may be sufficient to accomplish it. Since the majority of ores are usually more or less finely comminuted, and crushing will not completely liberate the ore from the gangue, it is desirable to have not less than two different fields in order to produce concentrates high enough in value to pass and middlings too poor to be used, but too valuable to be dumped, from which a large percentage of the value will be liberated by further crushing. For this reason machines are often placed in tandem, or two magnet units capable of different excitation are combined in the same machine, to treat the ore successively.

The separation of complex ores containing a number of components of different permeability often requires the application of a series of zones, varying from a relatively weak zone to a very strong one, mostly between attainable extremes. Ordinarily, for the provision of these zones a number of different magnet systems would be required, in order to furnish the necessary excitation, and such machines are bulky and costly owing to the material necessary for their construction.

A single electromagnet capable of performing the different functions at the same time is a desirable aim, in that it simplifies the machine, lessens its cost and maintenance, and permits the additional weight of magnets to be used for the enlargement of the capacity of the separators. One way of accomplishing this end hitherto has been to supply the upper pole with several edges,

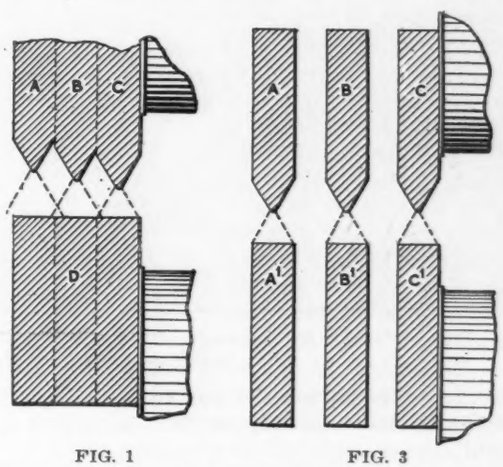

FIG. 1 FIG. 3

FIGS. 1 AND 3. OLD AND NEW METHOD OF OBTAINING THREE ZONES OF FLUX

each to provide a separate zone of field, the intensity of the same to be determined by its relative distance from the common lower pole with a flat face.

As Fig. 1 shows, the upper pole may have several edges *A*, *B* and *C*, which are consecutively placed in closer proximity to the lower pole *D*. From each edge a magnetic flux is supposed to diverge toward the lower pole, the strength of which is determined by the reluctance of the air path, so that from *A* to *C* the zones increase in strength. Several factors enter to disturb the accomplishment of this simple combination, and in fact the production of decidedly separate zones is not possible with this arrangement.

While the strongest zone has a distinctly convergent field due to its shortness, the following zones have fields of much less convergence; and even with only three zones, as shown, the second and third hardly show any effect as separating zones, as shown by the lines of iron filings in Fig. 2.

Owing to the fact that both the upper and the lower poles have the same magnetomotive force over their com-

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plete faces, the lines of force tend to distribute themselves according to the reluctance of the air path for each individual line, and most evenly over the flat lower pole face. Since in the shortest zone the difference in distance between the point and the base of the wedge-shaped field is large, the field, concentrating at the upper pole edge, necessarily will converge thereto to some extent, and this would be the same in the other zones, if they had the same air-gap length.

As the length of the zones increases with their successively lesser strength, the relative difference in distance between point and base of the wedge and the lower pole decreases, and therefore the resulting field is much less converging. In reality the total field, instead of the weaker zonal fields, converges toward the strongest pole edge *A*, and the result is that with any appreciable difference in zonal strength the strongest ore component, instead of being attracted by the weakest zone *A*, as might be expected, will move with the weaker components to the strongest pole *C* to be held there. Experiments with the arrangement from which Fig. 2 was made showed that a small steel ball, set in motion by the attraction of the field, would move through zones *A* and *B* toward *C*. Similar effects took place with irregular iron pieces and crushed magnetite.

The partial cause of this effect may be seen in the dotted lines of Fig. 1. For similar forms of fields in the three zones the weakest one would naturally occupy the larger area on the lower pole, while the strongest zone, owing to its shortness, could occupy the smallest area. Since just the opposite should take place, it is evident that the three zonal fields have to be disturbed in order to fulfill this requirement.

Zonal Conditions for Clean Separation

An arrangement suitable to overcome the difficulties as described above must satisfy the following conditions:

The m.m.f.[1] at the poles of each zone must correspond to the strength of the same. The field strength between the different zones should be as low as possible. The strengths of the different zones should not depend on the length of their air gaps. A variation in zonal strength should therefore be accomplished by some other means than by varying the length of air gap.

The invention (U. S. patent 1,132,016) described below fulfills these four conditions and has proved to provide a perfect form of field for producing zones of extremely different strengths in the same magnetic field.

[1]Magnetomotive force.

As Fig. 3 shows, an experimental form of this field is produced by employing separate upper and lower polepieces for the production of the three individual zones and having only the two polepieces of the strongest zone in direct contact with the electromagnet. The other pairs of poles are separated by air gaps from one another, thus introducing reluctances, which will reduce the m.m.f. symmetrically between upper and lower poles for each successive zone. While in Fig. 1, the flux from pole top *C* tends to flow to any point of the lower face *D*, in Fig. 3 this tendency is restricted to the fractional face C^1 of the lower pole, since a flow toward B^1 would introduce into its path the reluctance between polepieces B^1 and C^1. A magnetic flux seeks its path along the line of least reluctance, and therefore the flux will pass through C^1 at a greater density.

Similarly a flux from polepiece *B* would have no tendency to flow to A^1, and it will not flow to C^1 on account of the denser field present in the latter, which requires a higher m.m.f. for the flux to pass than *B* possesses.

In this arrangement the polepieces were made from 7/8-in. boiler plate and connected so that between individual polepieces horizontally and vertically there was an air gap of 3/4 in. width. The same material was also used to build the arrangement of Fig. 1. A mixture of magnetite and weakly magnetic hematite was clearly separated at polepieces *A* and *C*, the former holding all of the magnetite when *C* could gather all of the hematite. A bearing ball released into the field toward the weakest zone was promptly arrested there, and it showed no tendency to enter the stronger ones, although the acceleration is naturally high. The explanation is found in the compliance of conditions with the rule stated above. The space between the zones is filled with lines of force of relatively great length, as they originate from between the polepieces *A*, *B*, *C* and A^1, B^1, C^1 respectively. Consequently their density must be extremely low.

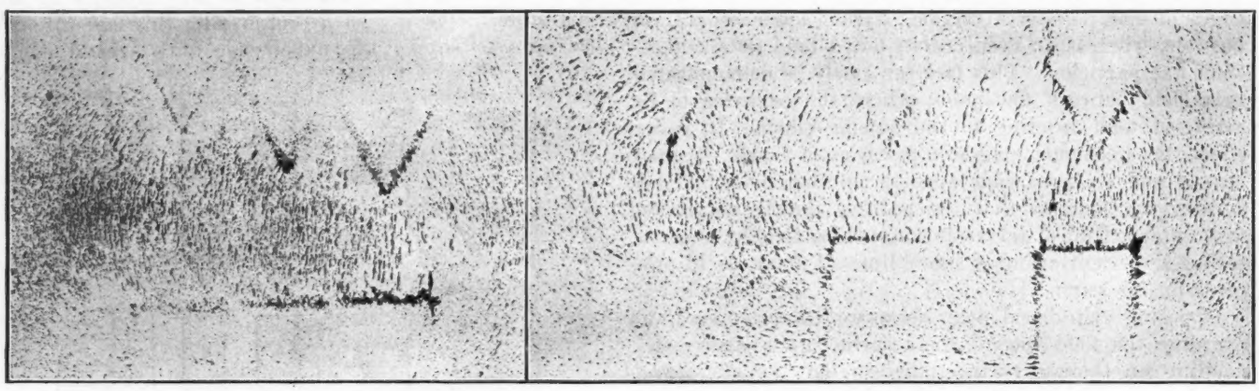

Fig. 2. Field in arrangement of Fig. 1

Fig. 4. Field in arrangement of Fig. 3

FIGS. 2 AND 4. LINES OF MAGNETIC FLUX SHOWN BY IRON FILINGS

In Fig. 4—a picture of iron-filings lines in the field shown by Fig. 3—it will be noticed that each zone is formed as perfectly as if it had no connection with any of the others, and each individual zone bulges in almost circular curves around its center. The length of interzonal lines of force can easily be traced and approximate deductions made as to their relative density.

Construction of Jobke Magnetic Separator

A drawing of a three-zone field designed for a full-sized working model of a separator is shown in Fig. 5. The distances between center lines of the zones are 3 in.

Each zone is dimensioned for the flux it is supposed to carry and for similar forms of zonal fields. This reduces the material required for the arrangement and also the space taken up by it. All three lower faces are 2 in. wide. While the two heaviest polepieces are bolted directly to the electromagnet, the other pairs are bolted immovably to them, and any vertical movement of the primary polepieces to secure a variation in the length of the air gap affects the other gaps equally; therefore a relative variation in the length of the air gap is not sought. Under all conditions the separating fields of the three zones have the same shape, and the most favorable form for the one zone is secured at the same time for the others.

The length of the polepieces for the different zones is varied to produce a certain ratio of strength, which in this case was determined as 1 : 5 : 10. A ratio as large as this one is unattainable in the arrangement of Fig. 1. Since this ratio of field strength is determined by the lengths of air spaces between successive poles and their vertical dimensions, which need not be changed if the maximum possible is provided for, a reduction can be made by reducing the reluctances in the different horizontal air gaps. This can be accomplished in the simplest manner by placing iron-bridging pieces, *D* in Fig. 5, across two or all zones, their section and permeability determining the reduction in reluctance. This method

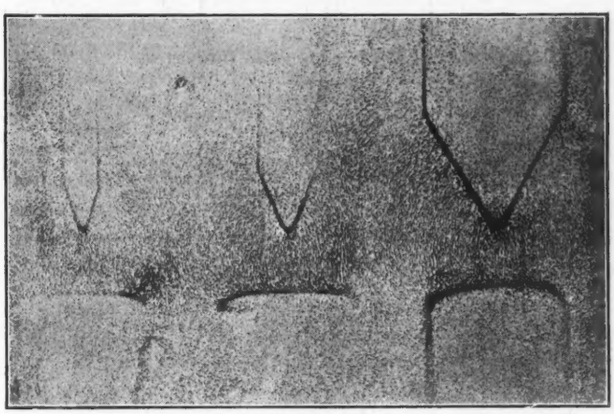

FIG. 6. LINES OF FLUX IN JOBKE MACHINE FIELD SHOWN BY IRON FILINGS

permits a regulation over the widest range, as either the thinnest sheet and wire or solid bars, filling the total air gap, can be employed. In this manner a wide range of usefulness is secured since the machine may be employed as a multizonal high-intensity separator, with extreme differences of strength, or as a concentrator of large capacity for strong and medium magnetic ores, since there can be several edges employed of slightly different strength to take off concentrates, or concentrates and middlings. The number of zones is not limited, provided the electromagnet is able to deliver the necessary flux.

Fig. 6 shows the lines of iron filings made by the machine of Fig. 5, which demonstrates that even here, with an apparent irregular shape of poles, the flux forms very regularly and that the space between zones is filled with lines of force of low density. The separator provided with this field has a single system of electromagnets of high intensity and a continued width of conveyors of 6 ft., and is therefore a machine of high capacity.

In this connection there is a point to be discussed that heretofore has often been wrongly defined, and it appears that even authorities are apt to take an erroneous view of the matter—namely, that a certain length of time is supposed to be required to magnetize a permeable particle in a field. The only factor that could enter into consideration is the induction of eddy currents, if the particle is of sufficient size and of high conductivity. The conductivity of all ores, however, is too low to permit this factor to be considered.

Experiments with iron laminated so as to avoid eddy currents have disclosed that as high as 400,000 alternations per second is not the upper limit in the speed of magnetization, and the conclusion is that the time factor does not enter into the magnetization of materials. That ore overshoots the field in a magnetic separator finds its cause in inertia, which increases with the square of the velocity. While the ore travels on the belt toward the field, its velocity is that of the belt itself. On near approach to the field it is accelerated by magnetic attraction until it is in the center of the field, and only from here on is magnetic attraction enabled to retard and stop it. This is the reason that one can observe a particle shooting past the field for an appreciable distance, to be pulled backward in a curve toward the upper pole. The ore must be removed from the traveling belt before the influence of the pull can cease. For this reason also the multizonal field must conform to the second rule before stated, so that the next stronger zone cannot affect the particle before the previous one has pulled it back.

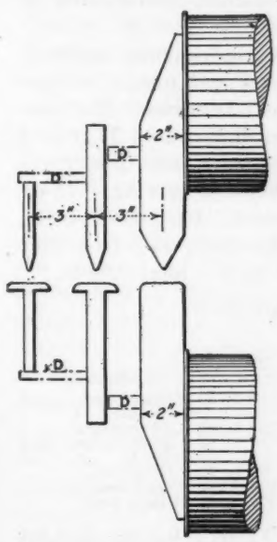

FIG. 5. JOBKE SEPARATOR THREE-ZONE MAGNETIC FIELD

Owing to the proximity of the zones to each other in the arrangement just described, the point may be raised that with a high speed of belt the time required for the ore to travel from zone to zone may be too short to secure a clean separation. Tests have proved that this is not the case and that a separation can be attained just as distinctly as in separate units.

This new form of field is not restricted to any particular type of magnetic separator, but lends itself to many different styles. Owing to its compactness (a pair of plate-shaped poles practically replace a complete magnetic system) it permits the raising of the capacity of the separator enormously. The machine has a pair of electromagnets of dimensions similar to those employed for a conveyor width of 1½ ft. The new apparatus promises to play an important part in the concentration of iron ores, where the lack of machine capacity has so far been an obstacle.

Mineral Exports from French Indo-China in 1915, according to a consular report, were 98,532 metric tons gold and silver ore; 397 tons tin and tungsten ore; 630 tons antimony ore; 33,335 tons zinc ore; 400,000 tons coal; 50,000 tons cement; 27,326 tons salt. One item of particular interest is the shipment during October-December, 1915, of 7,825 tons of zinc ore from Haifong to Baltimore and Galveston.

Flotation Tests on an Antimony Gold Ore*

By Earl R. Pilgrim†

The Sliscovich Mine is situated on Seward Peninsula about 20 mi. from Nome, Alaska, at an elevation of 1,100 ft. The lode is composed of quartz and stibnite. The ore assays from 18 to 40% antimony and from 0.1 to 0.2 oz. of gold. The gold is not evenly distributed throughout the ore, but appears in bunches inclosed in the quartz. The stibnite and quartz are so finely intermixed that coarse-concentration methods are impossible. Our problem in these tests was to determine the feasibility of separating the gold from the stibnite by flotation.

These tests were run on a Case experimental machine, mechanically agitated type; the ore was ground to pass a 60-mesh screen in all but the last series. The consistency of the charge for the machine was 6 H_2O to 1 ore. This was found to be the most satisfactory.

Assay of feed: Sb, 18.96%; Au, 0.13 oz.; Ag, 0.15 oz.

Screen test of feed: On 65-mesh, 4%; on 80-mesh, 9%; on 100-mesh, 26%; on 150-mesh, 25%; on 200-mesh, 25%; through 200-mesh 11%; total 100%.

TABLE 1. ACID VARIATION

No.	Variable %	% Concentration	% Sb in Conct.	% Sb in Tails	% Au in Conct.	% Extraction Au	% Extraction Sb	Remarks
1	0.0	50.0	13.9	11.0	50.0	50.0	42.0	Slight froth, excess gangue
2	0.2	39.0	34.0	8.6	6.0	94.0	67.3	Dirty gangue
3	0.3	52.5	30.0	6.6	19.6	80.4	83.0	Excess gangue, good froth
4	0.4	38.0	35.0	9.2	10.4	89.6	70.0	Good froth
5	0.6	31.5	40.0	9.3	00.0	100.0	66.3	Good clean froth
6	0.8	18.0	50.7	12.0	00.0	100.0	48.24	Slight froth

In the experiments shown in Table 1 0.15% pine-tar oil; time of agitation, 5 min.; speed of impeller, 1,550 r.p.m.; and temperature 9° C. were used. Pine-tar oil was used because of its ability both as a frothing and as a selecting agent. The low extraction of Au in the tails in No. 3 is due to the large percentage of concentration. The excess gangue carried the Au values into the concentrates.

TABLE 2. KIND OF OIL VARIATION

No.	Variable	% Concentration	% Sb in Conct.	% Sb in Tails	% Au in Conct.	% Extraction Au	% Extraction Sb	Remarks
7	Wood creosote	31.2	51.3	4.32	0.0	100.0	84.0	Tough bubbles
8	50% wood creosote, 50% sludge acid	23.0	54.3	4.80	2.2	97.8	66.0	Thick froth
9	Tar oil	23.0	41.5	12.10	0.0	100.0	51.0	Small bubbles
10	Castor oil, Tar oil, Turpentine	40.7	32.0	9.87	27.0	73.0	69.0	Thick froth
11	Pine tar	30.0	38.6	10.50	24.6	75.4	61.2	
12	Sludge acid	19.5	....	.....	....	.....	....	Brittle froth
13	Eucalyptus oil	25.0	32.8	14.30	7.7	92.3	43.2	Thick froth
14	75% sludge acid, 25% wood creosote	28.0	....	.....	....	.....	....	
15	Castor oil							
16	Stove oil							
17	Union Oil Co. No. 1							
18	Union Oil Co. No. 2							
19	50% stove oil, 50% wood creosote							
20	50% Union Oil Co. No. 1, 50% wood creosote							
21	50% Union Oil Co. No. 2, 50% wood creosote							

In the tests shown in Table 2, oil, 0.2%; time of agitation, 10 min.; acid, 0.3%; speed of impeller, 1,700 r.p.m.; and temperature 11° C. were used. All tests from 14 to 22 gave such poor results that they were not considered. Results show wood creosote to be best suited for this ore.

TABLE 3. AMOUNTS OF OIL VARIATION

No.	Variable %	% Concentration	% Sb in Conct.	% Sb in Tails	% Au Value in Conct.	% Extraction Au	% Extraction Sb	Remarks
22	0.05	17.5	51.3	12.0	Trace	99.9+	47.5	Light froth
23	0.10	20.0	53.0	10.47	1.1	98.9	56.0	Light froth
24	0.20	31.2	51.0	4.32	1.1	98.9	84.0	Good thick froth
25	0.30	37.4	36.3	6.10	3.1	96.9	83.3	Good thick froth
26	0.1	8.0	....	.....	.....	.....	....	Very light froth
27	0.2	19.3	....	.....	.....	.....	....	Slight froth
28	0.05	25.0	....	14.3	.....	.....	....	Good froth but not carrying Sb
29	0.20	16.0	....	.....	.....	.....	....	

In the tests of Table 3 wood creosote oil (22-25); sludge acid (26, 27); pine tar (28, 29); time of agitation, 10 min.; speed 1,700 r.p.m.; temperature 11° C.; and acid 3% were used. The tests using wood creosote were the only ones giving good results. The others were not assayed.

TABLE 4. IMPELLER SPEED VARIATION

No.	Variable (R.P.M.)	% Concentration	% Sb in Conct.	% Sb in Tails	% Au Value in Conct.	% Extraction Au	% Extraction Sb	Remarks
30	1,140	26.0	47.0	5.3	0.0	100	76.0	Thick froth, brittle
31	1 440	24.3	51.0	5.0	0.0	100	76.7	Bubbles
32	1,480	24.2	51.0	5.1	0.0	100	76.0	

In the series shown in Table 4 50% sludge acid and 50% creosote was used. Time of agitation, 12 min; 0.2% oil, and constant temperature of 12° C. It is rather interesting to note the apparent effect of varying the speed. It was decided that from 1,150 to 1,400 r.p.m., with a peripheral speed of from 950 to 1,320 ft. per min., was the best.

TABLE 5. EFFECT OF FINE GRINDING

No.	Variable (Mesh)	% Concentration	% Sb in Conct.	% Sb in Tails	% Au Value in Conct.	% Extraction Au	% Extraction Sb	Remarks
34	60	37.4	36.3	6.1	34.0	66.0	83.9	Good clean concentrates
35	100	38.0	38.6	2.5	1.0	99.0	90.5	Good clean concentrates
36	150	40.0	27.3	2.1	Trace	99.9+	92.4	Considerable gangue in froth
37	200	47.0	26.0	7.0	11.0	89.0	77.6	Considerable gangue in froth

In the tests shown in Table 5 the conditions were: 0.2% wood creosote oil; 0.3% acid; time of agitation, 15 min.; and constant temperature of 13° C.; and 150-mesh gives the best result. Other tests were run, varying the temperature, but the general effect of increasing the temperature was not noticeable.

*Conducted at University of Washington College of Mines.

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Celestite and Strontianite

Most of the strontium salts used in the United States are imported, the production in this country being small, according to University of Arizona Bulletin of Mineral Technology, Series No. 13. No production has been reported in this country since 1910. Deposits are known to occur in Arizona, and it is thought that they may be developed to some commercial importance.

There are two strontium minerals of commercial importance; namely, celestite, or strontium sulphate, and strontianite, or strontium carbonate. Of these, strontianite is the more valuable because it is more readily converted into salts desired for commercial purposes. Strontium is a metal, but does not usually occur as a metal in nature, nor is it commercially used in metallic form. Its salts, however, find various uses. The hydrate and the nitrate are the most important of these. Strontium hydrate is used principally in the recovery of sugar from beet molasses. The process is used in some

localities, but the cost of the hydrate is too great for its use to become general. Strontium sucrate is more easily formed, and for that reason its use has been urged in sugar factories.

Strontium nitrate finds its chief use in pyrotechny, owing to its property of imparting a red color to the flame. In various other forms, as iodide, bromide, acetate, carbonate, phosphate and other salts, it is used as a medicine and in the chemical laboratory. The demand for strontium mineral is rather small and fluctuating.

Electric Furnace in Norway Under War Conditions

One of the French periodicals that suspended publication at the outbreak of the war was the *Journal du Four Electrique et de l'Electrolyse,* which resumed in August, 1916. It calls attention to the fact that the war has given a great impetus to the use of the electric steel furnace and has witnessed the installation of a hundred or more of them, carrying the number in the world to above 300, whereas in 1913 there were hardly half that number. France has lost some that it already possessed, so that it cannot show an increase, but the United States is credited with constructing 50 last year and England with putting in 30 since the war began, while Germany, without new installations, produced 130,000 metric tons of electric steel in 1915 against 90,000 in 1914. Italy also is making additions. It may be presumed, although the writer does not so state, that the German increase comes in part from captured French furnaces.

A letter by M. Knudsen, from Christiania, is also published, reviewing the progress in Norway since the beginning of hostilities. The Norwegian works were overtaken by the war while executing contracts with belligerent powers, as a good part of the national production is for export. Some of these contracts were broken by force of circumstances, such as inability to get the raw materials, most of which are bought abroad. A crisis was feared, but a heavy war demand came in for such products as nitrates, carbide, cyanamide, ferroalloys and aluminum. The cost of materials and labor advanced and imposts increased, but high prices were realized. A long miners' strike turned into a general strike and lockout, which were ended by Parliament through compulsory arbitration. The banking and private reserves of the country are swollen to an unprecedented extent, for the war has enriched all interests that have to do with armament or shipping, even remotely. Some of the banks have even refused deposits, which has turned money to industrial openings, whereas formerly the capital for this purpose had all to be sought abroad. Industrial nationalism is in the air.

The Norsk Hydro has completed the installation of Rjukan II and increases its production of calcium nitrate and nitric acid. It is particularly interested in the manufacture of ammonium nitrate by combination of nitrogen products with the cyanamide furnished it by the Odda carbide works. The Nitrogen Products & Carbide Co., which owns these works and a majority of the stock of the Northwestern Cyanamide Co., by which the calcium carbide is manufactured into cyanamide, has installed a great industrial group at the foot of the Odda Fjord. Beside the carbide and cyanamide plants are erected factories for ammonium nitrate, nitric acid and perchlorate, which use over 70,000 hp. rented from the Tyssefaldene A. S. To complete this ensemble are the new Aura works, under construction.

Among new installations may be noted the increase of the aluminum plant of the Norsk Nitrid, at Eydehavn, near Arendal. The works have been doubled, and this same company is starting a new and very important aluminum factory at Tyssedal, in the Odda Fjord. In the line of ferros, the electrochemical works of Hafslund have considerably increased their production of ferrosilicon, as have also the Porsgrund works of the Motor company. Speaking of Hafslund, the Hafslund A. K. Co., which controls waterfalls and supplies power to the electrochemical works, has passed entirely under control of Norwegians, who have bought the stock (three-quarters of the capital) belonging to the German Schuckert firm.

The Kristianssand nickel refinery has increased its production; a new ferrochrome plant has been installed at Tyssedal by the Tyssefaldene concern. But the industries that are dependent on foreign minerals, such as special ferro, zinc, nickel, and aluminum ores, are far from sharing in the general prosperity, because raw materials are scarce and freights high. The group of the Elektrokemisk Industri has imparted activity to its affiliated concerns, the Arendal Smeltverk, which makes carborundum and ferrosilicon, and the Bjolvefossen, which is building an important carbide and cyanamide factory in the Hardanger Fjord.

A type of the new national enterprises is the Hoyangfaldene, or Norsk Aluminum Co., with exclusively Norwegian capital of 12,500,000 kr. ($3,350,000). This company has begun to utilize the waterfalls in the Sogne Fjord and to build an aluminum factory which will obtain raw materials from France.

Finally, there has been formed, with a small capital, the Florli A. S., which proposes to establish an electric steel works in Norway. This will be watched with interest, since steel is the only electric-furnace product consumed in the country.

Japanese Copper Production

Copper production in Japan for the first seven months of 1916 increased 20% over that in the corresponding period of 1915. Increases in the rate of output of the individual mines is seen in the following table, in which the second column gives the entire production for 1915 and the third column the seven months' production of 1916:

JAPANESE COPPER MINES PRODUCTION

	1915 Metric Tons	January-June 1916 Metric Tons
Ashio mine	12,176	6,568
Hitachi mine	12,038	7,162
Kosaka mine	7,278	3,487
Beshi mine	7,886	4,593
Osaruzawa mine	1,913	1,213
Ikuno mine	2,401	1,350
Abeshiro mine	2,379	1,640
Okoya mine	1,658	1,039
Obiye mine	1,574	1,516
Ani mine	1,322	676
Kamaishi mine	1,417	790
Kunitoni mine	1,111	644
Yaguki mine	958	535
Hannaoka mine	670	562
Kidigazawa mine	565	444
Hibira mine	992	597
Arakawa mine	805	...
Yusenji mine	819	276
Yoshioka mine	709	408
Okura mine	734	387
Nagamatsu mine	782	419
Oarasawa mine	751	299
Makimine mine	992	463

Details of Practical Mining

Method of Discharging Oil Barrel

By M. R. Percy

At the Sacramento Shaft power house of the Copper Queen, at Bisbee, Ariz., lubricating oil is discharged from the barrel to the storage tanks inside the house with the minimum of labor and trouble and the maximum of cleanliness and satisfaction. The accompanying illustration tells its own story. The barrel is hoisted by light

DISCHARGING AN OIL BARREL AT THE COPPER QUEEN

chain block and small-pipe derrick after it has been tapped and a nipple and valve screwed in. The oil flows into a funnel, as shown, and thence to the oil reservoirs inside, from which the engineers' oilers are filled by means of the usual spigot. No time is wasted waiting for the barrel to be emptied and removed, because it is up out of the way and can be taken care of at any time, and nobody's disposition gets damaged handling the barrel and spilling oil over the engine room. The arrangement is a good illustration of the little conveniences that tend toward smooth working—things that help to avoid waste and conserve energy.

Automatic Car-Closing Device

By L. A. Rossman*

For the last year the Oliver Iron Mining Co. has had in operation an automatic car-closing device at its Trout Lake concentrating plant. The Trout Lake concentrator is the largest plant for the improvement of iron ore in the world. As high as 500 cars of crude ore are brought to the plant and dumped during a shift, so that the closing of the dump cars is quite a problem.

Dumping is not a hard task, but to close 500 cars a day is difficult work. All the ore is brought to the plant in

A DEVICE THAT CLOSES 500 CARS A DAY AUTOMATICALLY

50-ton Sommers ore cars. The old way of closing was by means of a bar with which the sprocket wheel was turned. This method required four men, a great deal of strength and took considerable time. Besides this, the breaking of a bar, a common accident, often resulted in injuries to employees.

For two years experiments were carried on to secure an automatic closing arrangement. The earliest machines were operated by compressed air, the first one being an air drill attached to a duplex hoist. In another effort which was made, an air hoist was procured, the drum taken off and a sprocket put on in its place. However, this was not successful because of the lack of continuous power. In

*Grand Rapids, Minn.

the present machine the screw attached to the sprocket wheel, or spider, is operated by an electric motor. This machine has been eminently successful and works without a hitch. It is known as the Nicholls' Automatic Car Closing Device, named after its inventor, William Nicholls, superintendent at the concentrating plant. The machine is suspended from a 10-in. I-beam on trolleys so that it can move to all the cars. A box suspended close to the beam contains a magnetic control panel. The motor and the screw for the closing device are suspended on the same level with the sprocket on the car. The machine is geared down so that the screw is run at 11.5 r.p.m. It is fitted into the sprocket wheel as shown in the illustration. The power is turned on by a hand switch, and after the car is closed the machine is withdrawn. The whole operation of adjusting, closing and removing takes but eight or ten seconds.

Two men are required to operate the machine. It has thus been a saving in labor and even a greater saving in time. Besides this, it has eliminated a work that was quite dangerous. It has shown its efficiency in actual operation and should find a reception at docks and in many other places where such a device is a necessity.

The Flume at Braden*

The water destined for the production of power is taken from two small rivers which, although of small volume, have a very steep course; they are called the

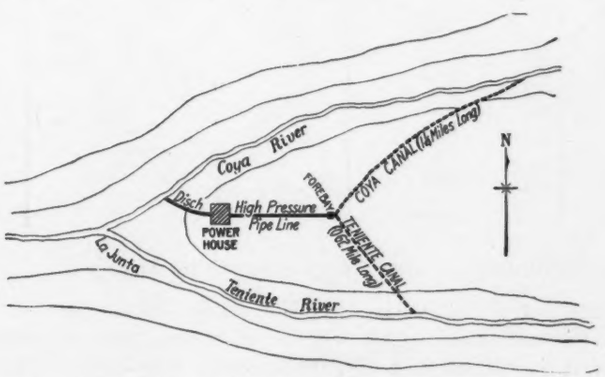


FIG. 1. GENERAL LAYOUT OF THE BRADEN HYDRAULIC SYSTEM

Coya and Teniente respectively. The maximum water is received in the rivers in October, November, December, January and February. The average for this period in the Teniente is 243 gal. per sec., and 361.9 gal. for the Coya. June, July and August are the periods of minimum supply, 55.5 gal. and 60.7 being the quantities for the respective rivers.

Fig. 1 shows the general arrangement of the flumes and pipe line. The diverting of the Coya water is effected by means of a small dry-stone wall 1 ft. 7 in. high, which is built across the bed of the river; this dam diverts the water to a wooden canal which, with a length of 1.24 mi., carries the water to the pressure chamber or forebay. The wooden canal rests on a ledge that skirts the base of the hills, and is covered in all its length to avoid the obstructions that might occur due to landslides, as the surface of the hill consists of loose earth and rock fragments. Subsequently the canal has been covered with this detritus in many parts without suffering harm.

The canal is 2 ft. 11 in. wide by 1 ft. 7 in. high. The casing is formed of 1-in. pine boards, 12 in. wide, reinforced every 3 ft. with a wooden framework. The covering is of loose 1-in. boards. The entrance to the canal is closed by a sluice gate behind which the canal is increased in width and depth. This portion acts as a settling chamber where, owing to the decrease in

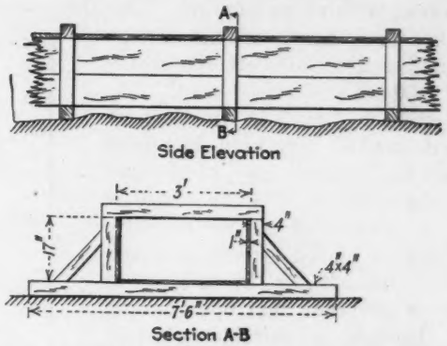


FIG. 2. DETAILS OE FLUME CONSTRUCTION

the velocity of the water, the sand and rocks carried along to this point are settled out at the bottom. From time to time four gates on the side near the bottom are opened, the accumulated material is discharged and the settling chamber cleaned. The velocity of the water in the canal is 4.25 ft. per sec.

The diverting of the water in the Teniente River is accomplished in the same manner as in the Coya, except that the flume is 2 ft. 6 in. by 1 ft. 7 in. in section and 0.62 mi. long.

The two canals are united 33 ft. before entering the pressure chamber or forebay. Details of the flume are

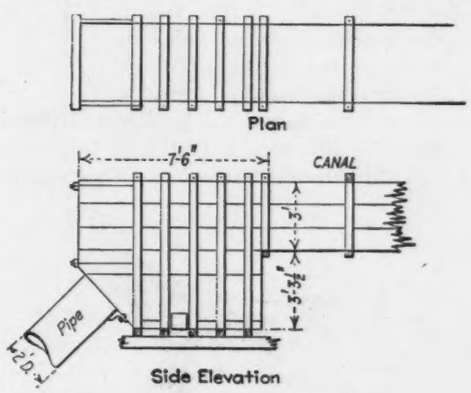


FIG. 3. DETAILS OF FOREBAY

shown in Fig. 2, and of the forebay in Fig. 3. This consists of a wooden box, to the upper part of which the incoming canal is fixed. To the lower part and on the opposite side the pressure piping is bolted. This chamber has a lateral orifice fixed at the bottom through which any solid material that may collect in it can be withdrawn. The details of construction and dimensions may be seen in the figure. This chamber has a wooden covering. The piping that extends in a straight line has a length of 3,280 ft. and drops 885 ft. between the forebay and the power plant. The piping is composed of three equal sections. The first section is 2 ft. in diameter, the second 1 ft. 7 in. and the third 1 ft. 6 in. The pipes that form this line

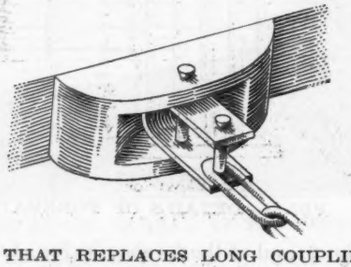
*Excerpts from "The Hydroelectric Installation of the Braden Copper Co., in 1909," in "Teniente Topics," June, 1916.

are each 23 ft. in length and are composed of five steel plates, riveted and having staggered longitudinal seams. The pipes are flanged and bolted together. The piping rests directly on the ground and in some places on wooden sleepers.

Properly speaking, there is no power house; the lower part of the piping branches into two parts of 12 in. in diameter, each one of which conducts water to a tangential waterwheel. A third branch leaves the main piping and operates a third waterwheel. The three waterwheels are alike, each being of the Pelton type and capable of developing 340 hp. at 930 ft. effective head. The Pelton wheel is 3 ft. 3 in. in diameter and carries on its periphery 32 bronze buckets; the nozzle, also of bronze, has a diameter of 2½ in. and is closed by means of a needle valve which may be moved directly by hand from the outside or by means of a ball-type governor that operates the needle through a suitable gearing. Two of these waterwheels supply the motive power for the concentrator, which has a daily capacity of 200 tons. The third wheel is directly coupled to a 3-phase 200-kw. generator.

A Handy Clevis

A device that has proved useful in mine haulage consists of a flat clevis that extends out from the locomotive bumper and saves the use of long coupling links, says R. Z. Virgin in *Coal Age,* Sept. 30, 1916. Often, when a locomotive goes in and out of the rooms over curves of short radius, the cars are derailed unless a long coupling is employed. The clevis shown is made of flat iron 4x½ in., with a 1-in. hole for the coupling pin. This clevis allows the link to swing sideways, and



A CLEVIS THAT REPLACES LONG COUPLING LINKS

when carried on the locomotive permits a coupling to be made at either end of the car. It is especially useful where couplings are permanently fastened to one end.

A Convenient Backsight

In rough country where it was difficult to get about and where the field party was small, the following backsight was used successfully. An ordinary block pad of white paper was cut so that the paper was square—about 3 in. on a side. Near one corner a small hole was punched, while near the opposite diagonal corner a larger one was placed. A piece of paper from this pad, placed on a pointed stick stuck into the ground at the time the rodman was there permitted him to go ahead and left a permanent backsight. The diagonal corners of the paper formed an accurate sight.

Handy Metal Expansion Chart*

By W. F. Schaphorst†

The chart herewith shown is handy to use in finding

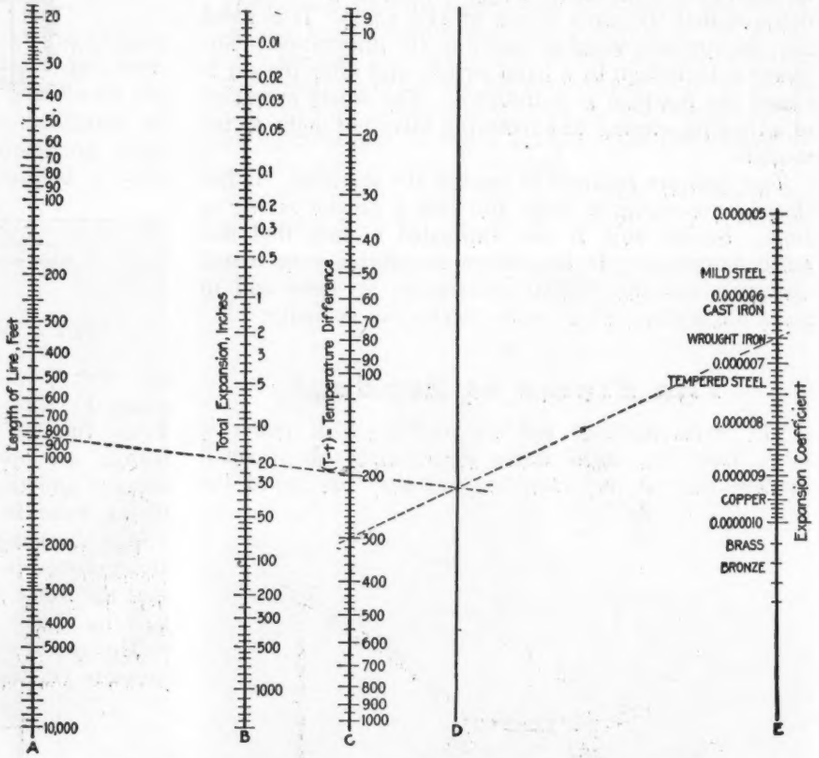


CHART FOR FINDING AMOUNT OF EXPANSION IN METAL

the number of inches expansion in any metal from mild steel to bronze. All lengths of steam pipe or metal structure from 20 to 10,000 ft. are included in its range.

Example: How much will 850 ft. of wrought-iron steam pipe expand when the temperature variation is 300° F.? Connect the 300 (column C) with the coefficient of expansion of wrought iron (column E) and locate the intersection with column D. Then, from that point of intersection run over to 850 (column A) and the expansion is found to be 20 in. (column B).

The temperature variation $(T - t)$ is found by subtracting the minimum temperature from the maximum. Thus a steam pipe at its coldest may be 40° F., and at its hottest it may be 440° F. The difference is therefore 440 — 40 = 400° F.

Thus all you have to do is to lay a straight-edge across the chart a couple of times and the total expansion in inches is determined without bothering with the decimal point.

It will be seen that this chart can be used for any material having a coefficient of expansion between 0.000005 and 0.000012. I have indicated the coefficients of the principal metals that fall between those limits.

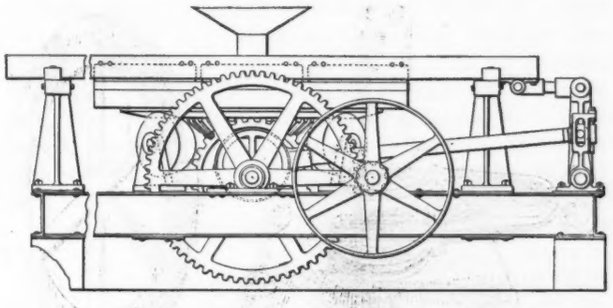
*Copyrighted, 1916, by W. F. Schaphorst.

†Mechanical engineer, Woolworth Building, New York City.

Details of Milling and Smelting

A New Type Grinding Mill

A grinding mill that is designed to reduce ductile metal in a flaky condition is covered by U. S. Patent No. 1,194,-757, granted on Aug. 15, 1916, to Thomas J. Lovett, of Chicago. This grinding mill consists essentially of two horizontal plates, the lower one made to rotate and the upper one to reciprocate. Ore is fed through the upper one and is subjected to the motions of the two plates. The result is a torsional rubbing action which tends to roll up flaky metallic particles into pellets and thus effect their separation from the gangue. The under side of the lower plate is fitted with one member of a bevel gear, the other member of which revolves in a vertical plane.



THE LOVETT GRINDING MILL

This is connected through shafting and gears to a pulley to which the power is supplied by a belt. An eccentric on the shaft connects through a toggle joint to the upper grinding member and thus imparts the reciprocating motion. The details of the mill are shown in the accompanying illustration.

The Use of Flotation Oils

Some experiments on flotation oils have recently been made by C. Y. Clayton and C. E. Peterson, the results of which were published in the August *Bulletin* of the School of Mines and Metallurgy of the University of Missouri. A large number of oils were examined and the general conclusions arrived at are, first, that it seems that the oils that are miscible with water are the frothing oils, and theoretically, at least, the oils that will give the ephemeral, small-bubble froth will give the cleanest concentrates when compared with an oil that forms a thick, stiff froth, but the recovery may be greater in the second case. To get clean concentrates, therefore, it may be necessary to sacrifice recovery, and vice versa, when using only one oil. With more than one oil a new problem comes in. From the small amount of preliminary work done, it was found that when mixing two oils in varied amounts, the frothing and selecting properties of the mixer did not always lie between the values found for the separate oils, tending to show the possibility of the formation of a chemical compound rather than a simple physical mixture; or at any rate, this would show that the physical properties of each were considerably modified by the presence of the other.

After studying the various oil groups and the flotation results, it has been said that, in general, the various groups behave in a similar manner in flotation. Even though this fact is granted a careful study of the physical and chemical properties of the oils does not lead to a solution of the problem of what property or combination of properties of an oil give it flotation value.

A comparison of the data secured through experimentation brings out the fact that as a class the essential oils give the best flotation on the dolomitic lead ore used in the experiments. While coal-tar creosote gives the highest-grade concentrates, oil of cloves would give the highest extraction, as indicated by the number of grams of lead obtained in a 20-min. test.

Safety in Use of Oil Burners

Serious accidents to engineers and firemen are of frequent occurrence from the practice of improper methods of lighting and handling oil fires, and A. C. McHugh calls attention, in a recent issue of *Power*, to a few general rules which, if followed, will greatly lessen the danger of injury to those using oil fuel.

Oil burners may be broadly divided into two classes—those that use steam for atomization of the oil and those that do not. As the former are more generally used, the present remarks will be confined to steam atomizing burners. These are of two types—the inside-mixture type, in which the oil and steam come together inside the burner and are introduced to the furnace through one slot; and the outside-mixture type, by which the oil and steam are introduced separately. There is, however, very little difference in the method that should be employed in lighting or handling either type.

In starting a new fire the steam should be turned on and the bypass opened in order that the oil and steam passage may be cleaned out and warmed up. The bypass should then be closed and the steam shut off. Then the damper must be opened. This is one of the most important things to impress upon one's mind. Do not try to start a fire with the damper closed. Next light a torch or bunch of oily waste and place about 10 to 12 in. in front of the burner, turn on a small amount of steam (just enough to carry the oil from the burner tip to the torch) and crack the oil control valve a little. As it generally takes some little time for the oil to fill the burner passage, do not turn on more fuel but wait until the passage is filled, when the fire will light easily.

Until the furnace is thoroughly warmed up, the fire should be closely watched, as it is easily put out, especially if either the steam or oil contains much water. Should the fire go out and the oil still be left to flow, the heat of the furnace will generate volatile gases that will appear at the stack in the form of grayish-white smoke. Should a torch then be applied, a violent explosion would occur. Cases are on record where these

gases have been ignited through the breechings of other boilers. The moment the fire is out, the oil should be shut off and the door opened. After a few minutes the gases will have passed off and the fire may be rekindled. When the furnace is hot, there is not so much danger, as the incandescent furnace will immediately relight the oil if its flow should be interrupted for a moment; but even then no chances should be taken, for it is in this way most men are burned. The fire goes out; the attendant opens the door and turns on more oil, expecting it to light immediately, which it generally does, to his sorrow. It is always cheaper to rekindle than to take a chance. In regulating a fire the attendant should hold the door open just enough to enable him to watch the flame and be in a position to duck his head in case of a flare back. To increase the fire the oil valve should be operated first, then the steam turned on until the flame is clear. If not enough steam is used, the flame will appear red and smoky; too much steam will cause the fire to look ragged and will have a tendency to extinguish it. In reducing the flame the steam is throttled down first, then the oil is reduced.

Once the fires have been set, they may be regulated over quite a range by increasing or decreasing the pressure applied to the oil supply without opening the fire-door or changing the steam supply. This can be done by manipulating the pump throttle or a bypass valve between the suction and discharge lines.

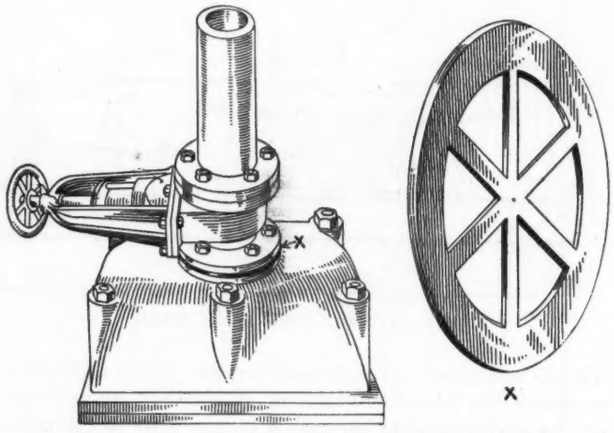
When extinguishing a fire, the flame should be cut down as low as possible; then by opening the bypass immediately after shutting the oil valve, the oil passage will be blown out without danger, as the flame will not be extinguished until the passage is clear.

Another point of great importance is that of air supply, or draft regulation. The importance of smokeless combustion is impressed upon the minds of nearly everyone. In fact, a smokeless stack is demanded of all oil-burning plants, but the truth is that a large percentage of these same smokeless plants are operating in utter disregard of fuel economy. One of the chief virtues of oil over coal as a fuel is the fact that on account of its volatile nature, it is more readily mixed with air, thus permitting the air supply to be reduced to a minimum. In properly designed furnaces but little more than the theoretical amount need be used; but in a great many plants little or no attention is paid to this, and as a result, the average oil furnace is more wasteful than the average coal furnace, because of the small resistance offered to the passage of air, there being no fuel bed to check its flow. Thus without close regulation large quantities of air are admitted to be heated and to flow blissfully from our pride, the smokeless stack. The proper method is to reduce the air supply until a faint haze is observed at the stack. This may at first seem difficult, especially with a large string of fires, but after a little practice an intelligent fireman will experience little difficulty even with a widely variable load.

In some plants the stack or breeching dampers are used entirely for air regulation, others use only the draft or ashpit doors, and still others, a combination of the two. From a safety point of view the writer prefers either of the two last-named, although it must be admitted that the pressure drop in the furnace due to the resistance at the entrance will stimulate air leaks through the settings to a greater extent than would be the case should the breeching damper be used. But on the other hand, the draft doors are generally more accessible and more likely to be used, and there is not so much likelihood of the dampers being entirely closed and the air supply shut off, for in this lies one of the greatest dangers. Should the breeching damper be closed while the fire is still on, the chances are that an explosion will occur, as the oil in the hot furnace will generate a large volume of volatile gas, which only awaits the admission of air to be ignited with disastrous results. To prevent the possibility of an occurrence of this sort, a safety stop should be placed so as to prevent the complete closing of the damper without removing the stop.

To Catch Loose Pump Valves

A strainer such as that shown in the accompanying illustration may be profitably used in the discharge line of a boiler-feed or other pump, says C. W. Watkin, in *Power,* Oct. 31, 1916. If any of the pump valves work loose, they are apt to get lodged in the pipe line or some of the valves. The best location for a strainer is next to the pump, but the one shown can be placed between



STRAINER IN FLANGE JOINT NEXT TO PUMP

flanges anywhere. It is made out of a sheet of brass or bronze cut to the diameter of the inside of the bolt circle and the web openings or perforations made of sufficient size not to obstruct the flow of water by decreasing the area of the pipe.

Coarse-Crushing Systems

In the installation of coarse-crushing systems in the most modern of wet-treatment mills, a tendency may be noted to avoid the practice of returning oversize material to a crushing machine of any kind. One of the newest large mills deposits the coarse ore from the mine into a bin from which it is fed into large gyratory crushers. Thence the material is delivered to another bin, and from there passes over a grizzly, where the undersize goes to the mill bin and the oversize passes through a group of disk crushers, there being no return, only one pass through the machine being made. Any further crushing required is given in separate machines, no provision being made for returning oversize material to a machine through which it has already passed. This arrangement has the advantage of simplifying the route taken by the ore, although it may require the installation of more crushing machinery.

The Assayer and Chemist

The Analysis of Tin Ores

By Tony F. Golick*

The increasing importance of tin has rendered necessary a more rapid and accurate method for the analysis of tin ores than has heretofore been available. The principal methods in use are the fire assay with KCN and Low's iodometric method. Any fire-assay process is obviously subject to large losses, and cassiterite ores are not readily decomposed by Low's method. The present method, worked out through the assistance of Prof. V. H. Gottschalk and R. S. Dean, is based upon the titration of the sulphide with potassium iodate, as has been described by Mr. Dean for other sulphides.[1]

The ore, whether cassiterite or sulphide, is decomposed by fusion with potassium carbonate and sulphur (1 part S to 1 part K_2CO_3), which we found may be most conveinently done in a Jena Erlenmeyer. About 45 min. is usually sufficient for complete decomposition of the ore. The melt is then treated with warm water and filtered, the tin passing into the filtrate as potassium sulpho-stannate. This filtrate is then evaporated and taken to acid sulphate melt, also most conveniently made in an Erlenmeyer according to the directions given by Low.[2]

This fusion is taken up with 1:1 HCl and treated with H_2O_2 to insure complete oxidation of the tin to the stannic state. The tin is then precipitated at SnS_2 by H_2S. This precipitate is filtered and washed free of H_2S. The sulphide, together with the filter paper, is then placed in a known amount of standard iodate and hydrochloric acid added so that the solution is 30% by volume strong HCl (sp.gr. 1.2) measured at the end of titration. The titration is then finished with iodate if an excess has not been added, or if an excess has been added it is titrated back with standard iodide solution using CCl_4 or $CHCl_3$ as indicator in either case. Some of the results obtained by this method are shown in the following table:

RESULTS OF ANALYSES OF TIN ORES

Pure Sn	C.C. Used	0.05 Molar Iodate, Theoretical
0.1	16.8	16.82
0.1	16.8	16.82
0.1	16.85	16.82
0.1	16.8	16.82
0.1	16.7	16.82
0.1	16.9	16.82
Sn. ore fire assay, 7.92%; iodate		72.7 72.85

By this method the sulphide is oxidized entirely to sulphur according to the equation,

$$SnS_2 + KIO_3 + 6HCl = SnCl_4 + S_2 + KCl + ICl + 3H_2O$$

which is found to be the most satisfactory, although by measuring the concentration of acid the sulphide may be oxidized partially to sulphuric acid. Accordingly, the acid present must be carefully regulated to the stated quantity. The iodate solution should be about 0.05 molar, and may be readily standardized by weighing, and is found to keep indefinitely. In the titration a bottle devised in this laboratory may be used to good advantage, a description of which will soon be published by O. D. Neal in the *Journal* of the American Chemical Society.

It seems possible that, according to Linden and Rector,[3] stannic sulphide might absorb H_2S and thus give high results, but our results have not shown this to be the case, and tests on other sulphides by Mr. Dean have shown that the amount absorbed is negligible.

While we have not made investigations over a sufficiently wide range to recommend the method for technical use, it seems possible that further work might find it capable of practical application. The method has the advantage of a permanent standard, and free access of air causes no difficulty since strange as it may seem, iodide solutions are perfectly stable in strong hydrochloric acid.

*School of Mines and Metallurgy, Rolla, Mo.

[1] "Journ. Am. Chem. Soc.," 37, 1134 (1915).

[2] Low, A. H., "Technical Methods of Ore Analysis," Wiley & Sons.

Pulp and Metallic Assays

By J. T. King*

In the *Journal* of Apr. 1, 1916, Donald M. Liddell gave a useful formula for the calculation of pulp and metallics problems in assaying. Those who have had many of these calculations to make will appreciate the importance and usefulness of such formulas. While assayer at the Temiskaming mine, at Cobalt, I had occasion to make daily a large number of assays on samples containing metallics. The ore at this mine was notorious for its metallics—almost half the samples contained them.

These samples weighed about 200 grams. After grinding, they were screened with a 100-mesh screen, the undersize being pulp and the oversize metallics. Any iron particles in the metallics were removed with a hand magnet. Two $\frac{1}{10}$ A.T. samples of pulp were scorified for each sample. The clean metallics were cupelled direct with sheet lead, while dirty metallics were first scorified. If the weight of the total metallics present was under $\frac{1}{20}$ A.T., all were assayed in one portion. When the weight was over this amount, one or more $\frac{1}{20}$ A.T. samples were assayed.

It was found expedient to have a formula for each case—when all the metallics were run, and when samples were run. The derivation of the formulas used is given here in detail for the sake of clearness, though their significance seems apparent in the final forms.

Formula used when all the metallics are assayed:

Let

S = Weight of the sample expressed in grams;
P = Weight of the pulp expressed in grams;
M = Weight of the metallics expressed in grams;
p = Assay of the pulp expressed in milligrams per assay ton;

[3] "Journ. Am. Chem. Soc.," 67, 63 (1895).

*University of Toronto, Ont.

m = Weight of the bead from all the metallics expressed in milligrams.

Now

$\frac{P}{29.16}$ = Weight of pulp in assay tons

$\frac{M}{29.16}$ = Weight of metallics in assay tons

$P + M = S$

$\frac{P + M}{29.16}$ = Weight of sample in assay tons

$\frac{Pp}{29.16}$ = Weight of values in pulp in milligrams

$\frac{Pp}{29.16} + m$ = Weight of values in sample in milligrams

Then

$\frac{Pp}{29.16} + m \div \frac{S}{29.16}$ = Weight of values in one assay ton of sample in milligrams

or

$Pp + 29.16m \div S$ = Ounces of values per ton avoirdupois

Formula used when the metallics are sampled:

Let

m = Weight of the values from the metallics per A.T. expressed in milligrams;

$\frac{P}{S}$ = The ratio of the weight of the pulp to the weight of the sample;

$\frac{M}{S}$ = The ratio of the weight of the metallics to the weight of the sample;

Now

$\frac{Pp}{S}$ = Weight of the values per assay ton from the pulp in milligrams

$\frac{Mm}{S}$ = Weight of the values per assay ton from the metallics in milligrams

Then

$\frac{Pp}{S} + \frac{Mm}{S}$ = Weight of the values per assay ton from the sample in milligrams

or

$\frac{Pp + Mm}{S}$ = Ounces of value per ton avoirdupois

For using the first formula, take the assumed example:

Sample weighed, 100 grams.

Pulp weighed, 97 grams.

Pulp assayed 100 mg. per assay ton.

All the metallics gave a 1,000-mg. bead.

$$\frac{Pp + 29.16m}{S} = \frac{97 \times 100 + 29.16 \times 1{,}000}{100}$$

$$= 388.7 \textit{ oz. per ton}$$

Case 2:

$\frac{1}{20}$ A.T. of metallics gave a 486.1 mg. bead, or 9,722 mg. per A.T.

$$\frac{Pp + Mm}{S} = \frac{97 \times 100 + 3 \times 9{,}722}{100} = 388.7 \textit{ oz. per ton}$$

Beryllium Extraction from Gadolinite

A large-scale method for the extraction of beryllium from gadolinite is described by C. James and J. A. Perley in the *Journal* of the American Chemical Society, Vol. 38, p. 875 (abstr. *Journ.* Soc. Chem. Ind., May 31, 1916). The method is not suitable for the quantitative separation of beryllium from iron, but is rapid and gives a product completely soluble in sodium bicarbonate solution.

The finely powdered mineral is decomposed by heating with concentrated sulphuric acid, the sulphated product extracted with water, the solution precipitated with a hot solution of oxalic acid, allowed to stand for 12 hours, and the rare-earth oxalates filtered off and washed with boiling water. The filtrate is treated preferably as follows: The solution is oxidized, e.g., by potassium bromate, to remove the oxalic acid, and ammonia solution is added (about a liter for an initial charge of 75 kg.), followed by a solution of caustic soda until the odor of ammonia becomes apparent. The mixture is well boiled, and the hydroxides, separated by filtration, are stirred with sufficient hydrochloric or sulphuric acid to dissolve about two-thirds of the whole.

The acid extract, containing the beryllium and some iron, is heated to boiling, precipitated with caustic soda until a little of the filtered liquid gives a light-colored precipitate with ammonia, and the whole filtered. The filtrate is again heated to boiling, treated with a little sodium hypobromite, and precipitated with caustic soda until the liquid gives a white precipitate with ammonia. The mixture is filtered, sodium hydrogen sulphide is added to the filtrate to separate the last traces of iron (the precipitate and the preceding precipitate containing beryllium being worked up with a subsequent batch of material), and after boiling off hydrogen sulphide, the beryllium is at once precipitated by adding a concentrated solution of sodium carbonate and boiling the mixture thoroughly. The precipitated basic carbonate is filtered off and well washed with boiling water. If the filtrate from the rare-earth oxalates be very rich in beryllium, it may be oxidized and the boiling solution precipitated with caustic soda until nearly all the iron is removed, and then the last traces of iron removed by adding more caustic soda and sodium hydrogen sulphide, as already described.

Hydrogen Can Be Generated Readily, according to O. Hutchins, of the Carborundum Co., by treating silicon with caustic soda.

$$2\,Si + 2\,NaOH + 3\,H_2O = 2\,Na_2O \cdot 2\,SiO_2 + 4\,H_2.$$

To produce 1,000 cu.ft. of hydrogen at 0° C. and 76 cm. pressure theoretically requires 49 lb. of silicon and 62.2 lb. of NaOH. The recovery under ordinary conditions is actually about 90% of the theoretical.

Simple Tests for Phosphates are given by W. B. Hicks in "Mineral Resources of the United States," 1915, part 2. For field use the simplest and most satisfactory method is to moisten the fresh rock surface with a drop of nitric acid (sp.gr. 1.2) and then place a small crystal of ammonium molybdate on the moist spot. Appreciable amounts of phosphates give a yellow color which spreads gradually through the crystal and over the rock surface. A more delicate test is to place a small quantity of powdered rock in a test-tube, add a few drops of nitric acid, warm over a flame and add an excess of ammonium molybdate solution. A rough estimate of the quantity of phosphate in the rock may be made by comparing the yellow precipitate with that produced by rock samples of known composition under similar treatment.

Company Reports

New Jersey Iron Mines in 1915, according to the report of the state geologist, produced 415,234 gross tons of iron ore; an increase of 65,099 tons, or 19%, over 1914. The ore marketed in 1915 was 391,115 tons, valued at $1,140,000. The stocks on hand at the close of the year were 178,284 tons. The total ore mined in New Jersey since 1870 has been 20,905,461 gross tons. In 1915 there were five important mines active in the state: Allen, Mount Hope and Richard in Morris County; Peters in Passaic County; Washington in Warren County.

The Right of Way Mines, Ltd., operating at Cobalt, Ont., reports for the year ended Dec. 31, 1915, that net receipts from ores mined were $12,253, and from interest $527, from which general expenses and depreciation of $8,334 were paid. The balance from operations plus previous balance leaves net of $13,189 on hand at the close of the year. Shipments during the year amounted to 102,274 oz. with 11,263 oz. estimated on hand on Dec. 31, 1915, the total having a gross value of $56,836, from which direct operating expenses of $44,583 were paid. High-grade orebodies seem to be exhausted, but there appears to be some hope of making a showing through the low-grade bodies at No. 2 shaft. A dividend of ½%, or $8,428, was paid Mar. 15, 1916.

Pittsburgh Steel Co.'s report for the year ended June 30, 1916, shows strikingly the prosperity that has come upon the American steel industry. The gross sales for the fiscal year were $21,848,036 as compared with $11,649,864 for the previous year. The net profits for the period were $4,564,067, after allowing $500,000 for depreciation compared with $858,160 in the year previous. Shipments amounted to 618,761 tons at an average price of $35.39 per ton as compared with 333,773 tons at $34.90 per ton in the year previous.

Total sales were $21,848,036. The manufacturing cost, including maintenance and repairs of $800,841, was $15,608,866, in addition to which provision for depreciation of $500,000 was made, leaving a gross operating profit of $5,739,169. Selling and administration expense was $1,194,260; other income, $19,158, making net profit to surplus of $4,564,067. The company decreased its capital obligations during the year by redeeming $3,000,000 of its own and $25,000 of its subsidiaries' notes and paid off a purchase money mortgage of $21,283. In addition it paid off all accrued dividends on its preferred stock and paid 4% on its common. Capital obligations are now $10,000,000 of preferred, $7,000,000 of common and $2,384,000 of funded debt, of which $1,009,000 has been called.

Colorado Fuel and Iron Co.—This company is the largest iron- and steel-making concern west of the Missouri River. It owns extensive estates and operates coal and iron mines in Colorado, Wyoming, Utah and New Mexico, and large iron and steel works at Pueblo in Colorado. The fixed liabilities are $36,235,500 common stock, $2,000,000 preferred stock, $45,005,000 funded debt. Current liabilities as of June 30, 1916, were $2,574,563; surplus balance of profit and loss, $4,922,127. As compared with the previous year, there were increases of $9,048,566 in earnings, of $6,467,538 in expenses and of $2,581,028 in net earnings. The report for the year ended June 30 gives production for two years past as follows, in net tons:

	1914-15	1915-16	Changes
Coal mined	2,329,069	3,241,505	I. 912,436
Coke made	520,261	702,061	I. 181,800
Iron ore mined	441,026	709,601	I. 268,575
Limestone	344,033	369,513	I. 25,480
Pig iron made	286,661	339,968	I. 53,307
Finished iron and steel	324,600	454,220	I. 129,620

Of the coal mined last year, 1,206,028 tons was sold; 761,506 tons used at the company's plants; 1,273,971 tons used in making coke, this being 1.81 tons coal per ton of coke.

Two increases, each of 10%, were made in the wages of the iron and steel workers, and one of 5% in wages of miners. The report goes at some length into the adjustment made of difficulties with the employees and the results so far attained. Regarding plant improvements the report says: "The improvement in the business and earnings has made possible a program of new construction and additions to equipment, essential to the most profitable operation of the business. A byproduct coke plant of 120 ovens is to be built at the Minnequa steel works, and other additions and improvements at various points have been authorized during the year. The estimated cost of these authorizations, all of which are chargeable to capital account, is $3,300,000 . . . . When the annual report of a year ago was written, the prospect of steel business with railroads, as well as with other trade, was not encouraging. However, the buying demand which commenced in the East about the middle of 1915 reached us in October, and during the last eight months of the fiscal year under review the mills producing wire and nails, merchant bars and other of the smaller products operated double turn, while the rail-mill production was close to its capacity. . . . Heavy rails represent more than 50% of the output of the steel plant, and as wage advances added materially to their cost, with no increase in the selling price, the average earnings per ton on all steel sold were not such as might have been anticipated in view of the high prices prevailing for certain steel products. In normal times the steel plant is dependent primarily upon railroad business, and it is the view of the management that every effort should be made to take care of the requirements of regular railroad customers during the period of abnormal demand in other lines. . . . The orders for steel already booked for forward delivery and the reasonable expectation of business from regular customers insure practically full operation of all mills up to July 1, 1917. Some orders for heavy rails have already been booked for delivery in the last half of 1917."

Seoul Mining Co., Holkol, Chosen, in its report for 1915 shows a total ore reserve of 1,221,331 tons, having a gross value of $13,460,210, as compared with 1,206,133 tons having a value of $15,914,375 in 1914. The ore is complex, containing gold and copper, and it is noteworthy that in the present estimate copper is calculated at only 15c. per lb. The usual dividend of 50% on the capital stock was paid during the year. The Suan mine has a total ore reserve of 114,616 tons, containing $9.20 in gold, 1.15% copper and 1.7 lb. of bismuth, or a total value of $13.67 per ton. In this estimate copper is calculated at 15c. per lb., and bismuth at 60c. The mill treated 83,560 tons of ore during the year, after discarding 6,257 tons as waste. The actual running time of the mill was 332 days of 18½ hours, or 91.16% of the possible time. The stamp duty per day was increased from 5.5 tons to 6.28. The flotation process installed during the previous year yielded excellent results, increasing the copper extraction from 56.24% to 75.35%, and a combined copper and gold recovery of 85.43% was obtained, as compared with 80.04% for 1914. The total yield from the mill was $899,443. At the Tul Mi Chung mine the total ore reserve is 1,099,715 tons, containing $6.57 in gold, 1.49% in copper, and 0.5 oz. of silver per ton. Early in 1915 a change from steam to electric-motor power was effected at the Suan mine and mill, and the plant is now working satisfactorily, reducing power to $73.13 per hp.-yr. as compared with $110 when steam power was used. The operating cost per ton is shown in the table.

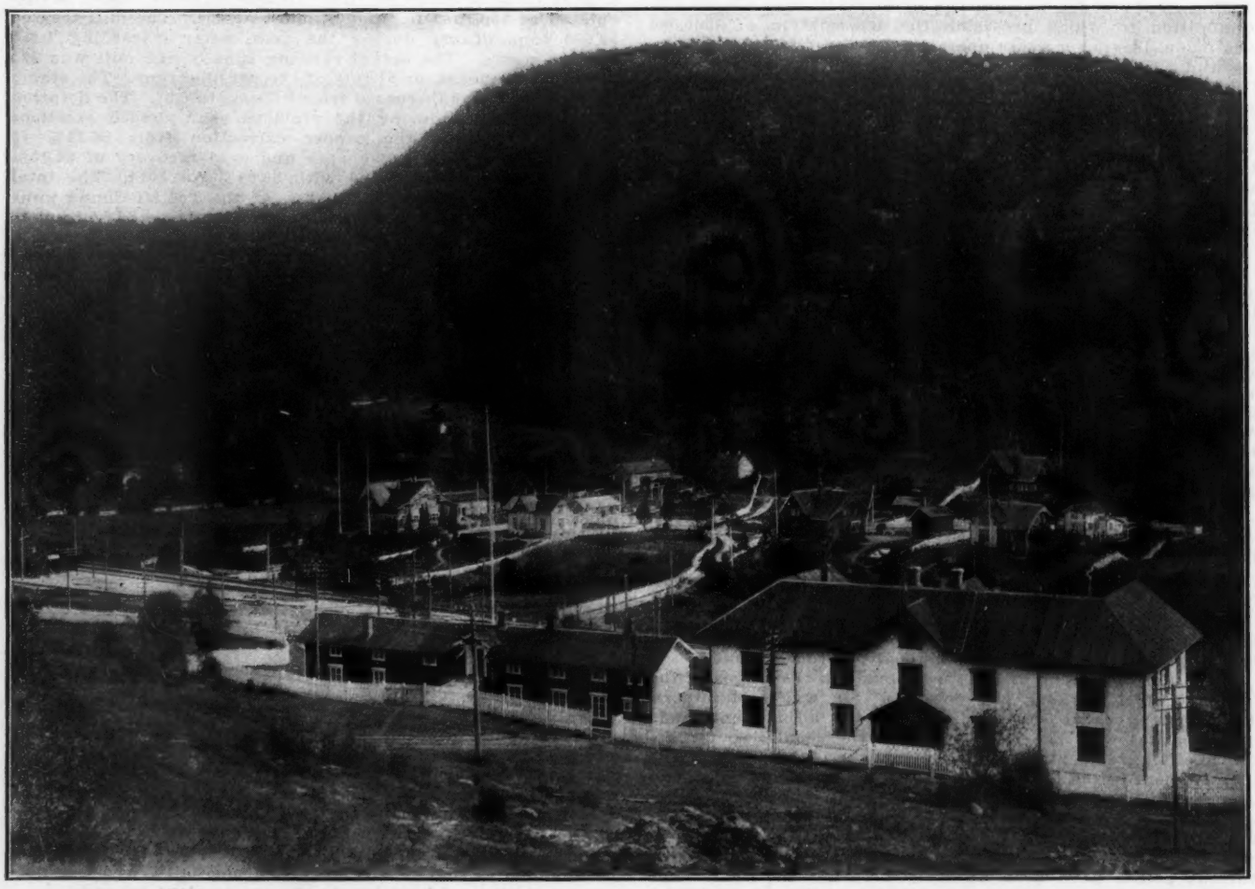
OPERATING COST OF THE SEOUL MINING CO.

Mining	$1.17
Starting and transporting ore to mill	.06
Milling	.90
Concentrating	1.05
Office expenses	.19
Agencies	.10
General expenses	.09
Insurance	.02
Freight and transportation	.02
Messengers and police	.03
Livestock	.02
Surveying	.02
Traveling expenses	.04
Cables and telegrams	.04
Bullion expenses	.02
Pesident's and secretary's offices	.10
Legal	.01
Hospital	.06
Total	$3.94

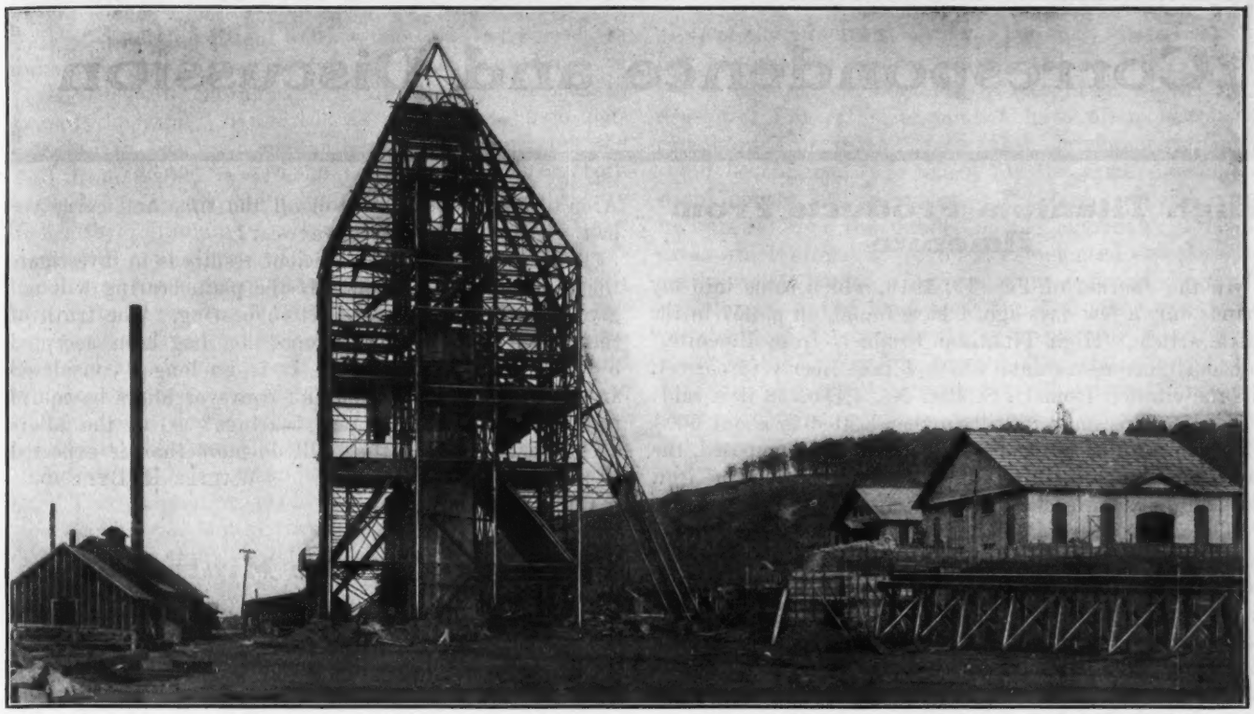
The average receipts per ton from all ores were $9.05, the operating cost $3.94, and the profit per ton $5.11. Operations are continuing, ore reserves are being increased, and an active prospecting campaign is in progress under the direction of Mr. B. V. Barton, who has the title of chief engineer of the prospecting department. The sum of $44,763 was spent during the year on this item, and a total of 6,253 ft. of work was done at the various prospects. Development warrants the recommendation that the milling capacity of the Tul Mi Chung mill be doubled, so that it will treat 700 tons daily, with the necessary addition of 1,000 kw. to the power-plant capacity.

Photographs from the Field

WORKINGS IN OLD PART OF THE LÖKKEN MINE OF THE ORKLA MINING CO., AT LEAST 250 YEARS OLD



OFFICE AND STAFF RESIDENCE OF THE ORKLA MINING CO., 16 MILES FROM THAMSHAVN, NORWAY



HEADFRAME AT THE HOLMES MINE OF THE CLEVELAND-CLIFFS IRON CO., ISHPEMING, MICH.

The headframe is 150 ft. high over all, and is the highest on the Marquette Range. It will have three crushers in it and is designed to crush and handle both hard and soft ore, making five grades. The concrete pier shown near the center will be 77 ft. high and will carry the No. 8 gyratory crusher. Two No. 6 crushers will be supported by the steel-work. The head-frame will be enclosed on the working floors. The shaft has four compartments, and will be equipped with two skips and a cage.

A KEYSTONE DRILL PROSPECTING IN CALIFORNIA

EMPTYING THE SLUDGE FROM THE BAILER

Correspondence and Discussion

High Titanium Products From Ilmenite

In the *Journal* of Feb. 19, 1916, which came into my hands only a few days ago, I have found, on p. 357 in the little article, "High Titanium Products from Ilmenite," obviously erroneous data which I take liberty to correct. In the citation from U. S. Pat. No. 1,156,220 it is said: ". . . This mass is still further heated to about 600° C., during which heating the titanium is decomposed, the iron sulphate remaining unchanged . . . The iron sulphate is then leached with water, . . . "

The temperature of decomposition of iron sulphates I know very well from experience, having made in 1906 to 1909 careful studies on the roasting of mixed iron and copper pyrites in a plant in the South Tyrol. The temperatures were controlled with a thermoelectric pyrometer with autographic record. The chief results of my studies—as far as the question here is concerned—are as follows: (1) Iron sulphate if heated to a temperature of from 480 to 500° C.—with or without the admission of air does not matter—readily changes into a basic sulphate, which is insoluble in water; (2) at a temperature of 560° C. the basic iron sulphate by persistent heating yields ferric oxide, a compound which is not only absolutely insoluble in water, but even resists diluted acids. See my publication, "Die Betriebe der Kupfererzbergau-Gewerkschaft Oss-Mazzurana in Predazzo," in *Metallurgie,* 1909, VI, Nos. 18 and 19. See also, H. O. Hofman, "General Metallurgy," 1913, p. 99, Table 53, and the thorough researches of Dr. Felix Warlimont on the temperatures of decomposition of the sulphates of Fe, Cu, Ni, Co (*Metallurgie,* 1909, VI, p. 130).

Concerning titanium sulphate and the temperature of its decomposition, I have no personal knowledge and have no literature at hand to get exact information. But what I believe I know is that: (1) It is extremely difficult to bring mineralized TiO_2—regardless of the mineral in which it be present—into solution with acids, and that (2) there is known only one basic sulphate of titanium (TiO, SO_4) which is already easily decomposed with water in the heat. So it does not seem necessary to perform the decomposition by heating to 600° C.

ROBERT HESSE.

Tsumeb, Southwest Africa, July 30, 1916.

Chilled Conveyor Idlers

The Nevada Consolidated works, of McGill, Nev., evidently have no faith in ordinary idlers. This is shown by the article on page 646 in the *Journal* of Oct. 7.

The Nevada people say that the surface of their idlers is wearing. It is true that they will wear if the bearings bind and let the belt slide along. In that case chilled-surface idlers are fine. But is this the object of idlers? Aren't they used to eliminate sliding friction? Aren't they supposed to roll all the time and carry the belt along without excessive wear?

The correct way to get efficient results is to investigate the bearings of the idlers. If the plain bearing will not give results, try the anti-friction bearing. The truth of the anti-friction bearing proposition has been accepted by 75% of the industries. It is no longer considered an experiment. Why shouldn't conveyor idlers be equipped with good anti-friction bearings? Give the idlers a chance to roll and they will do more than is expected of them.

WALTER R. BYLUND.

Chicago, Oct. 26, 1916.

Revision of the Mining Law

On the subject of mining-law revision, while I am by no means in favor of "patchwork," let us for the sake of lucidity first consider the things which could be instituted without abandoning the apex control or the prediscovery requirement and without interfering with the "phraseology" or "the wealth of legal definitions that have been rendered."

Of these the most important, undoubtedly, is a requirement that annual assessment work be recorded in the form of strict affidavits, with details and penalties. This would do away with about all the extensive fraud in this line which heretofore has been imposed on the public. And it would completely do away with the blackmailing practice of resurrecting dead claims after someone else has proved the ground valuable.

The matter of allowing cash paid instead of annual expenditure I regard as unimportant, but not objectionable if the cash amount be made somewhat larger than the work expenditure. Another desirable change is the provision for court review of Land Office decisions. The incompetency of Land Office officials to decide many questions presented to them is well known to all who have much business in that department.

Another change which (strangely, it seems to me) has not been brought out in any of the discussions is the injustice of requiring the same annual assessment and the same patenting prerequisite expenditure on a fractional claim as on one of full area. The present law requiring $100 expenditure on a claim makes $5 per acre for the full claim allowed by the Government, but permits of no reduction where the state law reduces the width of claims. In Colorado for 40 years claimants had to pay $10 per acre and in four of the counties $20 per acre. That is not just. But further, there is a positive advantage in an assessment according to the area of the claim; instead of enticing a locator to grab all the ground possible because it comes at the same price, let us rather encourage him to stake only what he seriously wants, cutting down his claim in either length or width in order to save on his annual assessment, thus leaving open more ground which may be explored by others. And furthermore, this tends to reduce conflicts, with their attendant litigation.

The same injustice applies to the required expenditure of $500 for patent work. The man who needs to take up a small fraction for protection should not be taxed such an enormous expenditure if he wishes to patent the same. Hundreds of claims have been patented with less than one-tenth of an acre, making the cost from $5,000 to $10,000 per acre. Of course both annual assessment and patent expenditure should have a healthy minimum; for annual assessment, say $5 per acre with a minimum of $25 a claim. The annual expenditure for a group at one point should be allowed; this is only meeting a natural physical condition. But it should be required that the work so done be in such position as to benefit each location, otherwise it should not be accepted. Applying an excess of expenditure to future years should not be allowed. I regard this as decidedly objectionable and almost without a redeeming feature. I fail to understand why so many advocate it. The proposition made by one writer to allow this for one year is not particularly objectionable.

Recording at the Land Office I regard as worse than useless. First, with anything like their present equipment, such a record is practically impossible unless all claims are taken by the sectional subdivisions, and even then such a record would be useless without also requiring the record of the annual expenditure. If any such record should be required it should follow, not precede, the record with the county recorder.

In regard to notices, monumenting, recording and patenting, our present law is fairly satisfactory, but much more stringent requirements as to number, size and marking of monuments would be an improvement. I think 60 days instead of 90 should be the time limit for recording. When the present law was made, there were no such means of communication as at present; and we should rather discourage the early "stake" man who tries to hold ground as long as possible without doing work.

The 33 questions do not bring out the subject of separating surface and mineral titles, which I regard as about the most important question involved, though A, C, D and E mention it in the *Journal* of Oct. 14, 1916. As aptly remarked by D, "If you divorce surface and mineral rights, you get rid of the town-site locator, timber grabber, etc." And if this can be accomplished, it goes far to dispose of the troubles encountered under other heads such as classification and discovery. Classification I regard as impractical in any event, and it is useless if surface and mineral titles are divorced.

The discussion on the size and shape of mining claims with reference to a law confining mineral titles to vertical boundaries discloses a wide variance in ideas. The 40-acre claim seems to me to be the most seriously detrimental proposition that has been advanced. The 40-acre advocates apparently have had their recent experience about the iron mines and low-grade coppers where such a claim would be satisfactory; but for high-angle precious-metal veins such a claim is entirely out of place. Among narrow, precipitous mountain cañons and ridges a quarter of a mile is a long, long way. Most discoverers would never go to see the far sides of their claim after once staking it. Remember that, in precious-metal veins, a mine—that is to say, an ore-shoot—is on the average less than 500 ft. in horizontal extent. No, the 20-acre claim now allowed is too large to serve the best interests of the public—the *development* of the mineral resources. For forty years Colorado has had 10-acre mining claims and in four counties 5-acre claims; yet Colorado is recognized as the best-developed mineral state, and I have often heard the complaint from other states that development capital could be obtained here when, for the same showing, it could not be had elsewhere. The large mineral claim withdraws from the public, in the aggregate, immense areas which often the locator does not need and does not really want. Under other conditions someone else might explore portions of these areas and find other veins. Remember that our law should be to promote the development of the mineral resources. The claim holder will look out for himself in dangerous situations. Since different districts naturally call for different-sized claims the only logical solution, it seems to me, is the small claim with the option of doing the work in one place for a group. This will protect the public and should satisfy the condition where a large area is required for economical operation (assessment work should be per acre anyway, not per claim). With D I like the hectare, and no one who has mined in Mexico seems to find fault with that claim unit. However, as a reasonable compromise, I strongly favor the 10-acre claim. Then there should be no limit to the number of locations allowed. Such abuse as this provision has provoked can be remedied by rigid requirements regarding notices and improvements.

As to the shape of claims, originally I favored strongly the 10-acre subdivision of sections because it is the only scheme which positively avoids conflicts. But the conditions brought out by E and F. S. Ross (*Journal,* Oct. 21, 1916)—and I know them to be only too true—have converted me from this plan. Now, having abandoned the regular subdivisions, I fail to see any substantial reason for adhering to the square form or even to right angles. J. Parke Channing (*Journal,* Oct. 21, 1916) shows the impracticability of this plan. Cardinal-point boundaries will only slightly help the looks of a mining-camp map, right angles will not help it at all, and both bring other difficulties. What is more to the point, both tend to promote the covering of ground that is not really wanted by the claimant and thus withdraws from the public ground that might be explored by others. Therefore my conclusion is that there should be no halfway provision in the shape of claims. Let us have the regular land-survey subdivisions, or let the locator choose his ten acres in any shape desired, with of course some maximum length, say 1,320 ft. It would seem to be well to allow the locator the choice of the two methods; then, where the section corners are readily found and the shape fairly satisfactory, he can have the advantage of patenting without the expense of a separate mineral survey.

The number of claims that may be located by one individual should not be limited. A limiting number may seem desirable in some localities, but is decidedly objectionable in others. I agree exactly with D.

I believe that discovery should not be required, certainly not until patent application. Separating surface and mineral titles goes a long way to dispose of the possible abuse of this privilege. The remarks of C, D and F (*Journal,* Oct. 14, 1916, pp. 721-2) are to the point.

I am emphatically against requiring a patent in seven years or any set time; a worse than useless requirement.

Denver, Colo., Oct. 27, 1916. VICTOR G. HILLS.

Central States Silver, Copper, Lead and Zinc in 1915

According to the special chapter or Mines Report, prepared by J. P. Dunlop and B. S. Butler, for the "Mineral Resources of the United States, 1915," the production of silver in the Central States in 1915 was 647,553 fine ounces. At the average price of 50.7c. per fine ounce, the value was $328,309, as compared with $267,089 in 1914, when the average price was 4.6c. higher. Michigan produced 585,933 oz. (90.48% of the total) as a byproduct from copper ores. The desilverization of about 23% of the concentrates from southeastern Missouri lead ores and a small output from copper ores gave a recovery of 57,756 oz. (8.92% of the total) from Missouri. The fluorspar deposits of Kentucky and Illinois yield lead-zinc ore as a byproduct, and from the lead concentrates from Illinois 3,864 oz. of silver was recovered.

In 1915 Michigan produced 265,283,378 lb. of copper, valued at $46,424,591, as compared with 164,344,058 lb., valued at $21,857,759, in 1914. Missouri produced 402,160 lb., valued at $70,378, derived mainly from concentrates from southeastern Missouri lead ores, but partly from matte shipped from the smeltery of the Missouri Copper Mountain Mining Co. The total copper production from Michigan and Missouri was 101,286,717 lb. more than in 1914 and 31,550,000 lb. more than for any one year since 1907.

The mine production of lead in the Central States in 1915 was 222,548 short tons, valued at $20,919,512, as compared with 203,845 short tons, valued at $15,899,910, in 1914. Missouri produced 95% of the yield, and the recoverable lead content of concentrates mined in Missouri in 1915 was 41% of the refined primary lead recovered in the United States from domestic ore. Oklahoma production decreased from 7,556 tons in 1914 to 7,306 tons in 1915, the output being double that of Wisconsin and Kansas. The output from Illinois, Wisconsin and Kentucky was greater than in 1915 and that from Kansas about 200 tons less.

The zinc output in 1915 from mines in the Central States is the largest recorded. The total, based on mine returns with deduction for separating and smelting losses, was 215,889 short tons, valued at $53,540,472 when computed at the average reported sales price. Missouri was the largest producer in the United States, with 136,300 tons, as against 105,994 tons in 1914.

The feverish activity in mining in some of the Central States is typified by the conditions in northern Arkansas, which made necessary the rapid construction of a narrow-gage railway from Rush to Yellville.

Hydro-Electric Plant Operation in Frigid Climates

In an article by Dr. Henry M. Payne in the *Sibley Journal of Engineering*, September, 1916, some interesting notes on the mining and handling of arctic frozen gravel are given. A particularly interesting point is the hydro-electric plant, situated 25 mi. distant from the treatment plant, in the North Fork of the Klondike River. Power is generated by two 3,000-kv.-a Westinghouse generators, driven by two 5,000-hp. Morris reactionary turbines, and the current is stepped up in water-cooled transformers from 22,000 to 33,000 volts for transmission. The plant is operated throughout the winter, during which the temperature is constantly below —50° F. and on some days below —60° F., by allowing the ditch to fill and freeze sufficiently to form a bridge at any point. The water is then dropped about a foot and maintained at that level. The intake pipe, 6 ft. 6 in. in diameter, is buried under 4 ft. 6 in. of gravel. Above this is an air space of 1 ft. 6 in., then a roof of poles, and a layer of 1 ft. of moss and 1 ft. of gravel respectively.

At intervals, along with this, transformers step the current down to 110 volts, and it is then passed through resistance coils of No. 8 iron telephone wires, which lie in the bottom of the ditch. These resistance coils serve as heaters and prevent a too great drop in the temperature.

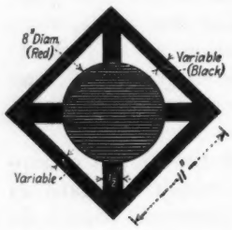
The water current is 2 mi. per hr., and in a long-continued temperature averaging from —40° to —50° F., the system is said to give absolutely no trouble.

Detroit Mine Safety Meet

By R. Dawson Hall

The National Safety Council held its annual meeting at the Hotel Statler, Detroit, Mich., Oct. 17 to 20; 2,500 persons were present. The American Mine Safety Association has recently been affiliated with the Safety Council and incorporated as the Mining Section. About 100 persons interested in the work of accident prevention in mines were present. They came from some distance, as Detroit is not in a mining district and does not furnish, therefore, any particular local attraction for mining men.

The new chairman of the Mining Section is B. F. Tillson, of the New Jersey Zinc Co. Mr. Tillson served as vice-president during the past year. The third vice-president is William Connibear, safety inspector, of Pickands, Mather & Co. The other two vice-presidents, H. G. Davis and W. A. Luce, are representatives of the coal industry. The secretary of the section is Edward Steidle. H. M. Wolflin, now in California and likely to be domiciled there for some time, is not well enough to accept duties additional to those pertaining to his official position, so it was thought better to secure someone who could maintain the relation between the council and the United States Bureau of Mines and who would be able to give the organization the most active assistance.



UNIVERSAL DANGER SIGNAL

The council adopted in its general session a "Universal Danger Signal," which is illustrated herewith. The intention is to use this symbol much as the red cross is used and to copyright it so that it cannot be put to any purpose other than to declare the presence of danger. It is not the intention that it shall be surcharged with any letters or warnings. These should be printed below. The signal looms up satisfactorily in the semidarkness, the red appearing as black and the white clearly showing its diamond form. This signal was shown in connection with several others in light of varying intensity and, it seemed, was unanimously preferred.

At the session held Wednesday, Oct. 18, addresses were read by Albert H. Fay on "Accident Statistics," by D. J. Parker and Edward Steidle on "Mine Safety Signs and Signals," and by H. M. Wilson on "Workmen's Compensation and Its Effect on Safety in Mining."

Albert H. Fay said that the fatalities in metal mines, when put on a 300-day working basis, were less numerous per thousand employees than those in coal mines based on the same number of days' run. It was intimated that the showing would be still more favorable to the safety of metal mines if the actual time worked by the miners were considered in the comparison, as many of the coal miners worked far less than eight hours. But it was urged that it would probably be impossible to secure figures showing how long a period the coal miner actually works.

F. W. Sperr, professor of mining engineering at Michigan College of Mines, Houghton, Mich., declared that the main need in mining was to correlate accidents with the methods of mining in which they occurred, so that the relative dangers of the many different systems adopted might be compared.

On the evening of Wednesday the members of the Mining Section held a dinner-smoker in the rooms of the Board of Commerce. T. T. Read, now of the New Jersey Zinc Co., delivered an address on China. He said that Japan, the coal deposits of which are inferior and which needs iron most sorely for its industries, has secured a hold in China on the best deposits of both and has gained large quantities of these needed minerals in Chosen. It seems likely that no further demands on China will be made. This assumption, of course, is based on the idea that the aims of the Japanese are industrial and not imperialistic.

The wage of the common laborer in China, Mr. Read said, is 8c. per day. Given this rate of pay as a postulate, the Chinese are doing everything in the most economical way. At such a low wage earth could be moved in baskets in successful competition with the best steam-shovel practice. When Chinese capitalists feel that their possessions are secure from revolution and political graft, they will begin to invest their hoards of unutilized capital and will build up the industries of the nation. This will not necessarily cause the "yellow peril" to flood the United States with cheap products. When China becomes industrial and ceases to be wholly agricultural, as at present, the increased activity will raise wages and automatically dam the flood that otherwise would sweep the United States. In that day the labor of China will be cheap no longer.

In the second session O. P. Hood delivered a paper on "Safety in Hoisting and Slope Haulage"—a paper that was considered one of the best presented. A discussion followed on the use of flat and round ropes. B. F. Tillson, the chairman, stated that the sewing of flat ropes could be done only by men with experience, and such men could not be kept at small plants or even at large isolated mining camps. Professor Sperr explained that the advantage of the flat rope was found in places with scanty headroom where the fleet of the rope on the drum would exceed 1 in 100. O. P. Hood said that the breaking of the stitching that binds the flat ropes together serves as a sort of safety signal, showing that an excessive strain is being brought on the rope units thus connected.

Another important paper was one by C. E. Pettibone on the "Testing of Rescue Apparatus." Mr. Pettibone urged that it was impossible by the ordinary tests to ascertain if the breathing apparatus was tight. It was not advisable to plunge the respiratory equipment in water, because damage to the apparatus would result. Mr. Pettibone's method was to raise the pressure in the breathing bag to 5 in. of water-gage. No equipment would maintain that pressure indefinitely, but it would be retained without appreciable loss for one minute where there were no punctures. Edward Steidle regarded the smokehouse test as more important and desirable. He said, however, that Mr. Pettibone's test was a good one.

H. I. Smith suggested that the smokehouse test was one that determined the condition of the apparatus as actually worn. The tightness of the nose clip was a factor in the safety of the apparatus. No test of the equipment apart from the wearer could determine whether the latter would be safe. Mr. Pettibone declared that the pressure was higher than any that would arise in use and therefore better than any the smokehouse test would develop. Edward Steidle, on the other hand, thought that such a positive pressure could be obtained if the wearer exerted himself greatly.

The argument seems logically to be as follows: If the breathing apparatus maintains a positive pressure, gas cannot inleak in the smokeroom; so if the puncture is not enough to eliminate the positive pressure, the apparatus will not permit the entrance of noxious gases.

Should, however, a negative pressure or a neutral pressure be created, the gas will enter. The smokehouse test therefore determines whether the puncture is large enough to permit the pressure to fall below that of the atmosphere. The increased pressure under exertion would aid in proving the apparatus safe, and therefore under increased exertion the test would not be so efficacious. The Pettibone test is of the rate of loss of pressure, whereas the smokehouse test merely determines whether the outleakage is enough to lower the pressure to such a level that an inleakage of noxious gas is possible.

J. W. Paul said that the test of oxygen supplied was not so unimportant as Mr. Pettibone had suggested. The bypass valve provides the oxygen needed, but in times of excitement men may forget to use it, with consequent unfortunate results.

Forfeiture of Mining Leases

By Arthur L. H. Street*

A recent decision of the United States Circuit Court of Appeals is instructive on the right of a lessor of mining property to forfeit the lease for inactivity of the lessee in development work. (Niles Land Co. vs. Chemung Iron Co., 234 Federal Reporter, 294.)

Complainant leased a tract of Minnesota iron-ore lands to defendant in 1902 for a term of 50 years, defendant agreeing to "work the mine or mines now or hereafter discovered on said land in a good workmanlike manner during the existence of this license." The lessee was also required to pay a tonnage royalty of 25c., $12,500 ground rent for the first year, and $18,750 annually thereafter, being credited, however, on such rental to the amount of royalties currently paid. By another clause of the lease, complainant, as lessor, was empowered to forfeit the lease on the lessee's failure to "work such mine or mines in a good, workmanlike manner," or "to pay the ground rent or royalty when due."

Claiming that the leased mine had not been worked by the lessee or its successor for ten years following the execution of the lease, except for exploration purposes, although the ground rent was duly paid and received by

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complainant without objection, suit was brought to forfeit the lease. The United States District Court for Minnesota decreed that, under the terms of the contract, there was no right to a forfeiture, and dismissed the suit. This determination has been affirmed by the Circuit Court of Appeals for the Eighth Circuit.

In the opinion of the higher court the lease was not so worded as to require the lessee to begin development work within a reasonable time or to conduct such operations continuously, as claimed by the lessor, payment of annual ground rent being interpreted as standing in lieu of actual operations. The court recognizes the point, however, that if the payment of tonnage royalties had been the only consideration for the lease, a different decision would probably have resulted.

In reaching the conclusion, the court applies the general rules of law that forfeitures of leases will not be decreed unless the lessee establishes a clear right thereto, and that clauses of doubtful meaning are to be construed most strongly in favor of the lessee.

As an additional ground supporting the decision, it is decided that the complainant's receipt of payment of the annual ground rentals for several years, without objecting to the delay in beginning development of the mine, amounted to an acquiescence on complainant's part in the lessee's apparent interpretation of the lease as not requiring development so long as the ground rent was paid.

Safety in Hoisting in Shafts and Slopes*

By O. P. Hood†

The practice of mining usually requires transportation of men and material in both horizontal and vertical directions. Man has pretty thoroughly accustomed himself to the means of horizontal transportation, and the risks of the road and the car are assumed naturally and without fear. Transportation in vertical directions, however, is far less ancient and general in the experience of mankind, and the dread and fear of falling is a primal instinct yielding but slowly to the experience of successful vertical transportation. A man who would never think of examining the coupling arrangements of a railroad train looks with suspicion on the 1½-in. steel rope that is to lower him a few hundred feet into a mine.

Safety in hoisting, as in most other activities, is dependent upon both men and mechanism. The division of the responsibility between these two is the object of this paper. The Bureau of Mines will issue shortly a study, by R. H. Kudlich, of shaft and slope accidents that have taken place in the coal mines of Pennsylvania, West Virginia, Ohio and Illinois in the 10-year period from 1904 to 1913. In this safety field, as in most others, the human factor is the most important. If man had succeeded in controlling himself as well as he has succeeded so far in controlling the mechanism of hoisting, shaft and slope accidents would have been one-third less. Of 1,726 accidents, 800 are so reported as to make it possible to establish the blame as between men and mechanism. Of these 800 accidents, 66% were due to human limitations and 34% to some failure of mechanism. In 35% of them the victim himself was responsible. It can be said that of three men injured in those accidents, one had himself only to blame, one suffered because of the failure of a fellow employee, and one suffered because of defective mechanism. The miner, therefore, who is using or who is about the hoisting facilities of a mine is equally interested in three factors—his own carefulness, the carefulness and ability of his mates and the adequacy of the company's equipment. The company interested in reducing shaft and slope accidents will find that there is twice as much need for revision of the habits, thoughts and practices of the men as there is of making any change in the equipment.

The accidents in which the injured man is himself more largely responsible are those such as the 10% injured in falling down shafts, the 6½% caught between the cage and shaft timbers, the 5% who fall off cages while riding and the 5% struck by slope or haulage ropes. The remedy for these accidents must be found in the general propaganda which teaches men to think of safety, together with the elimination of the habitually careless and of conditions that produce mental and physical subnormality. Accidents for which a fellow employee is largely responsible are those such as the 13% caught in overwinding accidents and the 7% injured by being struck by, or while riding on, runaway cars.

Human Safety Development More Important Than Mechanical

To entirely prevent these accidents requires infallible humanity or the development of accessory mechanism that will prevent the individual from doing the wrong thing and will supplement his ineffective effort. Here again the individual must be at his best physically and mentally. Anything that helps to produce a subnormal condition in a faithful and intelligent employee should receive careful study and be eliminated if possible. This leads the investigator into every field affecting the individual—health, wages, housing, normal pleasures, decent living, diet, the prohibition of artificial stimulants and drugs, etc. It may be too much to hope to produce ideal men and conditions, but it is necessary to face the fact that these human problems are the big end of the task. Overwinding devices are needed that are reliable and practical and that will not interfere with normal operation. Too often the devices provided are ineffective or are disconnected. In large hoists some of them may, when operated, even wreck the mechanism. Standard recording signal systems should be developed so that misunderstanding of signals will be impossible, and a permanent record made of the signals given.

The Analysis of Slope Accidents

The accidents where mechanism is largely at fault are those such as runaway cars on slopes, accounting for 9% of the injuries; breaking of ropes, 7½%; being struck by slope or haulage ropes, 4½%. Most of these accidents are on slopes. Of accidents on slopes or haulageways 25% are charged to failure of equipment, while in shaft accidents less than 9% are so chargeable. This is probably due to the more severe conditions imposed on slope and haulage ropes and to the absence of means on slopes of something comparable to safety catches in vertical hoists. To reduce accidents from defective

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mechanism requires, first of all, frequent careful, orderly and formal inspection of all mechanism and, second, the development of standards of condition that can be imparted by one to another. This latter need becomes very evident to anyone attempting to obtain from practical men about a mine definite directions for condemning a hoisting rope. The practice in this respect is arbitrary and variable, and only once in my experience have I heard directions so clearly given that an intelligent assistant could inspect a rope and report whether it should or should not come off.

In attempting to reduce shaft and slope accidents, it is useful to know the major problems which should demand first and greatest attention. These are shown to be human problems first and can be summed up in the phrase, "keeping good men fit." The problems of mechanism are more largely matters of efficient inspection than of design or material though these latter factors are strong minor subjects.

United States Steel Corporation

The preliminary statement of the United States Steel Corporation for the quarter ended Sept. 30 shows that the profits were greater than those of any quarter in the company's history. The single month of September showed greater net earnings than those of any quarter in 1914. The condensed statement is as follows, the net earnings being the surplus over operating expenses, ordinary repairs and renewals:

	1914	1915	1916
July	$7,475,993	$12,048,218	$25,650,006
August	7,584,926	12,869,099	29,746,903
September	7,215,083	13,793,327	30,420,158
Net for quarter	$22,276,002	$38,710,644	$85,817,067
		1916	
Depreciation and reserve funds		$10,614,659	
Interest and sinking funds		5,601,233	
Total charges			16,215,892
Surplus for the quarter			$69,601,175

From this surplus the regular quarterly dividend of 1¾% on the preferred stock took $6,304,919, leaving a balance of $63,296,256, which is equivalent to 12.45% on the common stock. From this the directors declared the regular dividend of 1¼% and an extra of 1%, taking $11,436,806 and leaving an undivided surplus of $51,859,450 for the quarter.

For the nine months ended Sept. 30, the total net earnings were $227,656,739, or $148,538,231 more than in 1915. The net result over all charges was $180,820,307, or $140,990,525 more than in 1915. The net surplus over preferred dividends was $161,905,550, or 31.8% on the common stock.

Depreciation and repair charges were high this year, because the mills were operated at high pressure and up to full capacity.

French Prisoners Work in German Mines

Two Swiss doctors, Blanchor and Speiser, delegated by the International Red Cross Society, have been permitted to visit the German prison camps more especially connected with employment in mines and shops, and to enter the underground workings. In their report, quoted by *l'Echo des Mines et de la Metallurgie,* of Paris, they state that in the region of the Seventh Army Corps—that is, the Werl-Semme-Minister-Friedrichsfeld district—more than 60 mines are employing French prisoners. Besides a minority of these who are miners by trade, there are many from other walks of life—farmers, accountants and merchants, but few students.

In writing to their families, the prisoners were not allowed to specify their actual places and nature of work, but had to date their letters from the main camps on which they depended. The first shift enters the mine at 6 a.m. and quits at 2 p.m., the second shift working from 2 to 10 p.m., which figures do not include the time spent in traveling between the mine and camp. Tuesdays and Fridays they work 10 hours to make up for Sunday. If, through fatigue, they refuse to work 10 hours, they are compelled to remain in the mine, where they rest on the coal. In the lignite mine at Alzendorf, Prussia, a prisoner who does not make up the fixed number of carloads is deprived of his evening soup.

In the iron-pyrites mine of Sachtleben, Westphalia, the last prisoner who had arrived at the mine bore the number 852, which by comparison with 487, the number of men then employed, showed that 365 had already been removed for some form of inability to work, such as accident, illness, feebleness or lack of skill.

At the Ehrhardt gun and munition works of Düsseldorf, prisoners refusing to handle war material proper are obliged to build or repair the machine tools used upon it.

The visitors somewhere found an order to the prisoners that they must work upon munitions, whatever their sentiments, and that they would be protected, upon return to France, by a certificate of the German government that they did it under compulsion. This was contradictory to a general military order, unknown to the prisoners, under which they could not have been forced to work on munitions against their will. At a Krupp plant in Rheinhausen, where railway material is made, 200 men of the night force refused to work and stood in the rain all night because they believed that the ingots were destined for ammunition work in another shop.

Australian Metallurgical Developments

MELBOURNE CORRESPONDENCE

The several metallurgical and smelting plants of the warring nations are alive with huge activity as a result of the European conflict. In Australia the great lead and zinc smelting and refining works of the Broken Hill Associated Smelters, Ltd., at Port Pirie (now the largest lead smeltery of the world, turning out about 130,000 tons of market lead per year), are undergoing extensive alteration and enlargement. Modern equipment and method is being installed throughout this plant by the new proprietors—a combination of the four important mining companies at the great Broken Hill camp in New South Wales. The Port Pirie plant, about 250 mi. to the southwest, on Spencer Gulf, was taken over from the former owner—the Broken Hill Proprietary Co.—in 1915; the new holders being the B. H. P. Co., the Zinc Corporation and the B. H. North and B. H. South companies.

Two American engineers are now at Port Pirie assisting in the expansion of smelting facilities. The reorganization and enlargement of the lead smeltery is under the guidance of Guy C. Riddell, formerly superintendent of the East Helena plant of the A. S. & R. Co.,

who has joined the staff of the Associated Smelters as consulting metallurgical engineer. Gilbert Rigg, until recently in charge of the research department of the New Jersey Zinc Co., has in hand the zinc program of the Broken Hill companies, which is undergoing extensive development at Port Pirie and in Tasmania. Charles M. Warner, of the Dwight-Lloyd company, has also been at Port Pirie recently, in connection with extension of the Dwight-Lloyd roasting equipment at that plant.

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Gold Production in Russia

Some new and interesting facts regarding the gold production of Russia are given in the *Journal* of the Russian-American Chamber of Commerce for June. The statistics presented are more complete than any which have been recently accessible and constitute a fairly complete review of the progress of the industry.

The following table gives the figures for 11 years from official sources, the first column showing the poods of bullion delivered to the official laboratories, the second the fine gold obtained, the value being here given in dollars, instead of rubles as in the original:

	Bullion, Poods	Fine Gold, Value		Bullion, Poods	Fine Gold, Value
1904	2,669	$24,690,304	1910	3,886	$35,617,269
1905	2,385	22,372,856	1911	3,738	33,567,096
1906	2,609	24,458,581	1912	3,554	31,779,341
1907	2,655	25,106,299	1913	3,715	32,758,073
1908	3,053	28,115,507	1914	3,766	34,458,088
1909	3,467	32,351,039			

In converting into dollars the ruble is taken at its face value of 51.5 cents.

The quantity of pure gold reported shows different rates of variation in several years from that of the bullion delivered to the laboratories. This was to be expected. Thus in 1914 there was an increase over 1913 of 50 poods only in bullion delivered, but the increase in pure gold was 155.325 poods. The recovery of fine gold by districts was as follows for four years past, in poods:

	1911	1912	1913	1914
Urals	442.625	446.800	392.975	299.575
West Siberia	294.750	273.025	288.925	132.975
East Siberia	2,438.975	2,198.100	2,325.300	2,729.975
Total	3,176.350	2,917.925	3,007.200	3,162.525

Referring to the first table, it will be seen that there was a decrease in 1905, resulting from the events following the Japanese war. From 1906 onward there was an increase each year until 1910, when the maximum was reached. In 1911 and 1912 there was a decrease, due to a limitation of output in some districts of East Siberia and to the labor troubles in the Lena District. In 1913 and in 1914 there were considerable gains. The returns received for 1915, though not quite complete, indicate a production about equal to that of 1914, or possibly a little larger.

In former years it was customary, in estimating the gold production of Russia, to add 10% to the official reports, to cover gold not reported or delivered to the official laboratories to be refined. This gold, it is believed, was concealed or illicitly exported, especially in East Siberia. If this rule be applied to the production of 1914, it would bring the total up to $37,905,000. There is reason to believe, however, that recent administrative measures and the extended operation of mines by large and responsible companies have reduced considerably the percentage of illicit or unreported gold.

It is to be noted that the figures above put the gold output of Russia in recent years considerably higher than the estimates which have been published abroad. The figures here given are stated in detail and appear to present the real production of the Empire.

The most important event of 1915 in the mining industry was the Congress of Gold and Platinum Producers held at Petrograd in February. This body debated many questions and recommended several measures. Following this the Ministry of Trade and Industry made a detailed investigation which resulted at once in the beginning of the building of new roads and other improvements in transportation, and in the better division and adjustment of the mining districts in Siberia.

Other measures included the reduction of the land tax on gold fields; permission to import free of duty cyanide of potassium, zinc in sheets and some kinds of machinery; the prohibition to export gold abroad; the establishment of a special premium for gold delivered to the government; and, finally, the establishment of a permanent committee at the Ministry of Trade and Industry to handle matters concerning the gold industry and to investigate its conditions.

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American Miners Murdered in Korea

According to an Associated Press dispatch, Oct. 11, from Seul, Fin Welhaven, who is believed to have been an American, has been killed and two other American mining engineers have been wounded in an encounter with armed bandits, who ambushed the party in northern Korea with the object of robbery.

The Americans and others connected with the Oriental Consolidated Mining Co. were returning to the mine on Oct. 6 carrying $75,000 in cash for operating expenses, when they were attacked from the brush by nine highwaymen. A policeman and the Chinese driver of the wagon in which the Americans were riding were shot dead, and Mr. Welhaven was so badly wounded that he died the following day. Two other Americans named Williams and Barstow were shot, though not dangerously. The bandits were driven off and the cash saved.

Mr. Welhaven was a brother of Alfred Welhaven, manager of the Oriental mine, which is about 60 miles from the nearest railroad. Once a month the output of bullion, which is about $150,000 is taken by an armed bullion party to the nearest station and thence to the mint at Osaka, Japan. On the return trip the party usually carries about $75,000 in cash for paying the mine expenses.

Upon communication with the New York office of the Oriental Consolidated Mining Co., the report of the death of Mr. Welhaven is confirmed, but no further information is available.

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The South African Diamond Yield for the first six months of 1916 is given in the July statistical report of the Mines Department of the Union of South Africa, quoted in the "South African Mining Review." The total production of the Union is put at just over a million carats, valued at £2,118,145. Of this the De Beers Consolidated Mines, Ltd., is responsible for 608,321 carats, valued at £1,260,469, while the alluvial diggers of Barkly West produced 36,811 carats, valued at £231,380. In the Transvaal the yield was 274,431 carats, valued at £375,180. Of the latter £111,605 was contributed from a dozen alluvial-bearing farms in the Klerksdorp district. Mines in the Pretoria district, virtually meaning the Premier, yielded 251,690 carats, valued at £261,378. This yield was almost entirely from tailings, 614,000 loads being washed; the diamondiferous ground washed up to the end of June being insignificant. There were in July 183 whites and 2,924 natives employed on diamond mines in the Pretoria district. The production in the Orange Free State was 82,171 carats, valued at £215,376.

Editorials

The Prospects for the Metals

The future becomes somewhat clearer, or seems to. The war has now been going on so long that economic conditions are not quite so chaotic. The operation of immutable natural laws is not quite so obscure as it was a year ago. What will happen when comes the great readjustment following peace, nobody is yet wise enough to prophesy. Probably it will be exactly what ought to happen, just as following the outbreak of the war, but nobody will have clear enough perception to see it any more than they did in August, 1914. But while the war continues, we have learned certain marks to go by, and that it will continue into 1917 seems now to be as certain as anything can be.

The development of the war produced an extraordinary demand for all metals, which are the basis of nearly all war material other than food and clothing. The supplies of certain metals, especially zinc, were cut off by the isolation of Germany and Belgium. The new demand for other metals—such as aluminum—increased to proportions previously unheard of. These conditions led to advances in price to extravagant figures, in some instances to five times what they were before the war.

In most cases the shortage of supply wherewith to meet the new, urgent demand was not due to scarcity of raw material, but rather to insufficiency of plant for its conversion into useful form. The enormous margins that represented premium on smelting capacity naturally induced the provision of new capacity. Thus, about a year ago the erection of new zinc smelteries was proceeding fast and furiously. Such a movement had a series of logical results, viz.: It created an increased demand for structural material and labor and increased the price of them. As new capacity became available, there was increased demand for labor to operate it and the exaction by labor of higher terms and, incidentally, the exhibition by labor of less efficiency. Both of these things increased cost of production. On the other hand, it was inevitable that the new production would sooner or later equal the demand and that the price would decline. Furthermore, it was certain that in the end the industry would be found to be greatly overbuilt, with a large amount of capital locked up in useless plant. The last condition was likely to be intensified by the stimulus given to the development of new processes resulting in the permanent relegation to desuetude of some otherwise good plant.

In the zinc industry we have seen all these things happen except the last. Not yet has it become necessary to abandon plant to any great extent; indeed, plant building is still going on. We speak especially of the zinc industry, for the experience in it pictures exactly what is going on in others. The stress of conditions in zinc was more intense and more rapid than in other instances, for the world was suddenly confronted by a deprivation of a large part of its supply, which was not so with copper and lead. We are now witnessing in copper, and to a much less extent in lead, a delayed repetition of what happened in zinc. We may therefore attempt to forecast their future with reasonable confidence.

Assuming that the war is going to continue into 1917, there is going to be a continued large demand for the metals. Indeed, this is so well recognized that a large proportion of the expected production of copper in 1917 has already been contracted for. Producers have sold about all their expected output up to 1917. Belated consumers have to pay large premiums for near-by copper. Stocks do not exist. This is very reminiscent of zinc 12 or 18 months ago. Producers are straining themselves to increase capacity. There is a plethora of raw material—ore, matte, and blister copper—and there is a surplus that either cannot be smelted or be refined. The congestion is especially in the refining. Although new refining capacity is being provided it cannot be done fast enough. The phenomenal records of zinc-smelting construction cannot be matched, for a copper refinery is a more complicated construction, is dependent upon electrical machinery, and the manufacturers of the latter will not promise delivery inside of seven months. Yet nothing is more certain than that some day the requisite refining capacity will be available, stocks will begin to accumulate and price will begin to recede. Even now there are producers who are keen on entering into contracts for delivery nine months or a year ahead at prices materially less than the current. All of these things happened in zinc.

The same things will happen also in lead, but with modifications owing to peculiarities of the lead industry. The smelting and refining of lead is far more concentrated than that of copper and zinc. The market is better organized, in that a large part of the domestic consumption is filled on contracts settled on average prices. Consumers do not therefore become panic-stricken with fear that they may not get any lead. If they have contracts, they know that they will get what they need at the average price. We do not therefore see such sales running far ahead as we have of copper and zinc. We have seen on the other hand, a lead market fluctuating in moderation, barring one or two brief periods of extravagance, during the last two years. Nevertheless, the production of lead is increasing through stimulation of mining and additions of plant, and that will eventually produce the same result as in other metals. The output of lead in Utah and Missouri has increased largely during 1916.

Nickel has been even more orderly. The production of it in North America is practically in the hands of a monopoly. The fact that the mines are in Canada and the refinery in the United States has caused the production and sale of this metal to be conducted with great circumspection. Aluminum, which is also in the main the production of one company, has risen in price threefold, simply owing to the urgency of the demand for it. Of all the metals this is probably in the strongest position, the major part of the output of the Aluminum Company of America through the whole of 1917 being under contract. Strenuous efforts to increase aluminum production, not only in the United States but also in Scandinavia, are

being made, but this involves more tedious construction than even a copper refinery, including as it does both electrical machinery and hydro-electric development.

With some of the minor metals, such as antimony and tungsten, conditions were simplest. No elaborate plant for the beneficiation of their ores is necessary. They appreciated greatly in value at first, owing to scarcity of ores, which was not due so much to the stinginess of nature as to the previous absence of great demand for them. The first sharp rise in prices adjusted conditions, and by stimulating the production of ores, reduced the prices. There is no more reason to anticipate a renewal of extravagance in such markets than there is in zinc.

However, the factors that we have dwelt upon in this article have produced new conditions in production. The cost of materials and of labor have increased enormously; the efficiency of labor has decreased. Naturally this has been of the greatest influence in those branches of industry wherein labor is the most important factor. In zinc smelting, for example, it is the all-important factor. No matter how good a plant the engineer may build, no matter how efficiently the metallurgist may direct it, their efforts may be completely neutralized by bad furnacemen. The copper-smelting furnace, on the other hand, is more completely controlled from the office. In general, the industry of mining and smelting copper has been far more highly mechanicalized than other branches of mining and metallurgy, barring iron and steel. This exhibits itself in the cost sheets. The big copper producers are showing costs per pound of copper but little higher than in normal times. The zinc producers, whose industry is least mechanicalized, talk on the other hand of 7 or 8c. per lb. being no better than 5 or 5½c. before the war, and probably there is truth in their contention.

Assuming, then, that the war is going to continue through or well into 1917, there is reason to anticipate for the metals a continued large demand, which will be filled at gradually diminishing prices, while profits will contract even more sharply than prices, for the reason that costs will continue to rise. The copper producers will probably be pinched least, for the reason already advanced. It is conceivable that we may settle generally upon a plane of price 40 or 50% above normal, whereon nobody will realize any more profit than he used to in normal times, and we may move on such a plateau for a long time before the factors of further readjustment come into play.

In the intoxication of the moment people lose sight of adverse influences that are operating even now. The American crop failure has attracted very little attention, but it was a disaster of major character whereof more will be heard. The increasing cost of living, the unrest of labor, the riot of speculation, the growing extravagance of the people, the anchoring of capital in new plant which may be of but ephemeral usefulness—all these factors and others are operating toward the natural results.

Total Output Ore Contracts

An interesting case involving an ore contract was recently decided in the United States District Court for the Southern District of New York, the Eustis Mining Co. being the plaintiff and Beer, Sondheimer & Co. the defendant. The Eustis Mining Co. mines pyrites in Canada, sells it to sulphuric-acid manufacturers on the Atlantic Seaboard, and takes back the cinder, which it has been selling to Beer, Sondheimer & Co. for smelting at Norfolk, Va. The contract between these concerns contained the clause: "It has been agreed between us that we (Beer, Sondheimer & Co.) purchase from you (Eustis Mining Co.) for the period of 10 years beginning July 1, 1914, and ending July 1, 1924, your total production of lump cinder estimated to be 12,000 tons per year, on the terms and conditions of our contract of Feb. 11, 1914." Later, the Eustis Mining Co. tendered a larger quantity than 12,000 tons a year, which Beer, Sondheimer & Co. refused to accept, wherefore the suit.

The controversy hinged upon the clause herein quoted and was reduced to simple terms. The plaintiff contended that the determinative provision was "total production." The defendant contended that the words "estimated to be 12,000 tons per year" was a determinative qualification. The court decided in favor of the plaintiff.

Inasmuch as the case is going to be appealed, it is useless to discuss the points involved. This is merely another one of those cases, whereof there have been several since the outbreak of the war, involving conditions that were mutually understood as long as everything was going along on even keel, but became uncertain when the boat began to rock. Ore contracts are apt to be rather uncertain documents. The moral is that there should be greater care in drawing them and greater safeguarding for both sides against extraordinary contingencies, impossible as they may appear at the time of contracting. The irregularities resulting from the war have been a lesson to a good many persons in that respect.

Cost of Hydro-Electric Power

A correspondent asks us to give the readers of the *Journal* an explanation of why hydro-electric power is relatively so much cheaper in some foreign countries than in the United States. In the United States there is scarcely any hydro-electric power available at less than $20 per horsepower per year, while in Scandinavia there are large developments from which power is supplied at $7.50 per horsepower per year and even less. He says, "Is this owing to cheaper material, cheaper labor, etc., abroad?"

Less cost of construction probably plays a part, but the chief reason for the difference is that in Scandinavia it has been possible to develop water power from high heads and near points of use. The cost of developing water power is greatest when power is to be obtained from a large volume of water at relatively low head, as for example the power development from the Mississippi River at Keokuk, Iowa. The necessity for erecting a dam of enormous size leads especially to great capital outlay. The plant cost is least when power is developed from a relatively small flow of water from high head. When hydro-electric power can be developed close to its market, the cost of transmission lines also is less than when it is necessary to distribute over a wide area.

In brief, the chief determinative factor, which creates the difference between water power at $7.50 and $27.50, is overhead charges; that is, principally plant cost in the first place. Norway and Sweden are not the only countries that enjoy very cheap hydro-electric power. There are other countries that possess similar conditions; namely, large volumes of water at high head available close to seaports.

BY THE WAY

The 400,000 shares of the new Tennessee Copper and Chemical Co. will have no par value. Wall Street accepts such issues now as a matter, of course, says the *Evening Post*. It is even more surprised now when new companies do issue shares with a par value than when they do not. This change has been agitated for years. It is strange that it did not begin to be extensively adopted until a tax was accidentally laid on a percentage of the par value of shares traded in. Wall Street found it could avoid the tax simply by removing the par value, which was useless and misleading anyway. The plan is now being adopted on its merits. Still, old habit is strong. When some of the new stock issues begin to sell above 100, Wall Street will probably talk of them as "crossing par."

Short-measuring gasoline pumps, according to an investigation by the Federal Bureau of Standards, are mulcting motorists of millions of dollars a year. In Illinois alone the loss is not less than $500,000 a year. Tests in many cities have confirmed previous conclusions, and actual tests of the types of pumps used by retailers at the bureau here have shown 80% of them to give short measure. "It is safe to say," says an announcement by the bureau, "that in all localities not under an efficient and competent weights-and-measures administration, and in a large majority of those which do have a relatively competent administration, the condition of measuring pumps is such that the motoring public is being subjected to regular and continuous shortage in its purchases of gasoline." We should like to know whether this is another indictment against the Standard Oil Co., or whether it has something to do with the "New Freedom."

The miner who produces gold bullion has no difficulty in marketing his product. He deposits it with the Mint—or with the bank, the express company or refiner, as intermediary—and gets his money. It is not unnatural that he regards the disposition of his copper, lead and zinc as being an equally simple matter and is ignorant of the hard work of the experienced and expert sales agents two thousand miles away, who lie awake of nights in studying schemes to sell advantageously and in strenuous competition with each other the commodity whose proceeds must meet payrolls, supply bills and dividends. Now and then only is the troubled sales agent relieved by a "sellers market," when buyers hunt him up. Commonly it is the other way. It was the other way last July in the lead market—strange as it may seem in its present strength—and one producer that obtains a good deal of its supply from Idaho was very energetic in cutting prices for the simple reason that it wanted to sell its lead and get money for it. Other producers—not to be backward—met the competition, and the price for lead declined rather sharply, with the leading interest trying vainly to stay the decline, which it stoutly maintained to be unjustified by the statistical position. The idea of the selling of Idaho lead in such a way as to depress the market seems to have been unpopular in Idaho, judging from the remarks of local newspapers, which say that it was all a lie, anyway.

October Mining Dividends

Dividends disbursed in October, 1916, by 43 United States mining companies making public reports amount to $12,326,705, as compared with $5,911,791 paid by 31 companies in October, 1915. Iron, metallurgical and holding companies allied to mining paid $6,002,519, as compared with $3,315,458 a year ago. Canadian, Central American and Mexican companies paid $1,871,641, as compared with $1,359,588 in October, 1915.

United States Mining Copanies	Situation	Per Share	Total
Ahmeek, c	Mich.	$4.00	$800,000
Allouez, c	Mich.	2.50	250,000
Ariz. Commercial, c	Ariz.	.50	132,500
Ariz. United Min., c	Ariz.	.01	25,000
Bunker Hill Con., g	Calif.	.02½	5,000
Bunker Hill & Sullivan, l.s	Ida.	.25	81,750
Caledonia, l.s.c	Ida.	.03	78,150
Champion, c	Mich.	6.40	640,000
Cresson Cons., g	Colo.	.10	122,000
Doctor Jackpot, g	Colo.	.01	28,441
Empire Copper	Ida.	.05	50,000
Golden Cycle, g	Colo.	.02	30,000
Grand Central	Utah	.04	20,000
Hecla, l.s	Ida.	.15	150,000
Homestake, g	S. D.	.65	163,254
Inspiration, c	Ariz.	2.00	2,363,934
Intermountain	Mont.	.005	8,250
Iron Blossom, s.l.g	Utah	.10	100,000
Isle Royale, c	Mich.	2.00	300,000
Judge Mn. and Smelt., s.l	Utah	.25	120,000
Midwest Sulphur	Wyo.	.01	2,750
Missouri Zinc Fields, pfd	.....	2.50	.....
Nat. Zinc and Lead, l.z	Mo.	.02	10,000
New Idria, q	Calif.	1.00	100,000
New Jersey Zinc	U. S.	10.00	3,500,000
North Butte, c	Mont.	.75	322,500
Osceola, c	Mich.	5.00	480,750
Pacific Mines Corp	Calif.	.01	6,420
Pittsburgh-Idaho	Ida.	.04½	34,400
Portland, g	Colo.	.03	90,000
Prince Cons., s.l	Utah	.02½	25,000
Shattuck Arizona, c	Ariz.	1.25	437,500
Silver King Coalition, s.l.z	Utah	.15	187,500
Silver King Con., s.l.z	Utah	.10	63,758
Superior, c	Mich.	1.00	100,000
Tonopah Belmont, g.s	Nev.	.12½	187,504
Tonopah Extension, s	Nev.	.15	190,920
Tonopah Min., s	Nev.	.15	150,000
United Verde, c	Ariz.	.75	225,000
Vindicator, g	Colo.	.06	90,000
Wellington Mines, g	Colo.	.02	200,000
West End Cons	Nev.	.05	89,424
Wolverine, c	Mich.	6.00	360,000
Yellow Aster	Calif.	.05	5,000

Iron, Metallurgical and Holding Companies	Situation	Per Share	Total
Am. Smelters, pfd. A	U. S.	$1.50	$249,747
Am. Smelters, pfd. B	Mex.	1.25	375,000
Bethlehem Steel, com	U. S.	7.50	1,114,650
Bethlehem Steel, pfd	U. S.	1.75	260,890
Brier Hill Steel, com	U. S.	1.50	182,010
Brier Hill Steel, pfd	U. S.	1.75	87,500
California Explor	U. S.	.12	28,139
Cambria Iron	U. S.	1.00	169,360
Cleveland-Cliffs, i	U. S.	2.50	184,253
Crucible Steel, pfd	U. S.	1.25	312,500
Dominion I. & S., pfd	Can.	7.00	350,000
Eagle-Picher Lead, pfd	U. S.	1.50	15,000
Gulf State's Steel, 1st pfd	U. S.	1.75	22,050
Republic Iron & Steel, pfd	U. S.	5.75	1,437,500
St. Mary's Min. Land	Mich.	2.00	320,000
Sloss-Sheffield, pfd	U. S.	1.75	117,250
U. S. Smelting, com	U. S.	1.00	351,115
U. S. Smelting, pfd	Mex.	.87½	425,555

Canadian, Central American and Mexican Companies	Situation	Per Share	Total
Butters Salvador, g	C. A.	$0.25	$37,500
Can. Min Corp	Ont.	.18	275,243
Cons. Min. & Sm. Co., c.z	B. C.	2.50	209,830
Hollinger, g	Ont.	.05	120,000
La Rose, s	Ont.	.05	74,931
Lucky Tiger	Mex.	.09	64,380
McKinley-Darragh-Savage, s	Ont.	.03	67,431
N. Y. & Hond. Rosario	C. A.	.50	100,000
Nipissing, s	Ont.	.50	600,000
North Amer. Magnesite	Que.	5.00	9,330
Peterson Lake, s	Ont.	.01¼	42,032
Porcupine Crown, s	Ont.	.03	60,000
Seneca-Superior, s	Ont.	.20	95,777
Standard Silver Lead, s.l	B. C.	.02½	50,000
Tough-Oakes, s	Ont.	.12½	65 187

The dividends by Superior Copper, Arizona Commercial, Arizona United and Intermountain were initial payments. Missouri Zinc Fields, Ltd., payment was on account of accumulated back dividends.

The totals for the first ten months of the year are as follows: Mining companies, $147,323,020, as against $57,311,674 in 1915; iron, metallurgical and holding companies, $94,996,663, as against $65,441,802 in 1915; Canadian, Central American and Mexican mines, $17,309,881, as against $7,441,708.

Personals

B. B. Thayer left for Montana on Oct. 31.

Frank A. Foote has gone from Delta, Utah, to Butte, Mont.

H. C. Klaus has gone from Berkeley, Calif., to Leadville, Colo.

C. P. Peterson, recently at Sudbury, Ont., is now at Duluth.

O. G. Engelder has gone from Houghton, Mich., to Jerome, Ariz.

George Watkin Evans has returned to Seattle, Wash., from Alaska.

C. T. Carnahan, recently at Los Angeles, Calif., is now in New York.

Allen W. Jackson, recently at Temagami, Ont., is now at Buffalo, N. Y.

John Smeddle, recently at Detroit, Mich., is now at Oatman, Ariz.

Vaughan Huneke, recently at Sutter Creek, Calif., is now at Hedley, B. C.

Corey C. Brayton, of San Francisco, has gone to Idaho and Utah on examination work.

Arthur Jarman, recently at the Waihi mine, in New Zealand, is now at Sunderland, England.

John L. Malm, of the Malm-Wolf Co., Denver, Colo., is in Chicago on professional business.

Fred L. Lowell, deputy mine inspector of California, is making an official visit in Mariposa.

Donald M. Liddell is traveling on professional business through the Illinois and Oklahoma oil fields.

R. E. Chase, Jr., recently at Tacoma, Wash., is now with the Chile Exploration Co. at Chuquicamata, Chile.

R. J. Flaherty has returned from an exploration of the Hudson Bay region, where he spent fifteen months.

F. W. Bradley is back from his usual summer sojourn at his mines in Alaska, and is now at the Bunker Hill & Sullivan.

R. E. Lewis, general superintendent of the Lehigh plant of the Bethlehem Steel Co., has been elected a director of the company.

L. D. Huntoon recently examined the Bullion Mine at Keystone, S. D. He expects to return in the spring to do some drilling.

A. G. Burrows, of the Ontario Bureau of Mines, has made a geological examination of the country along the Canadian Northern Ry. in western Ontario.

J. W. Gebb, deputy mine inspector of California, is making official visits in Fresno and Madera counties, having recently completed work in Nevada County.

Percy E. Hopkins, assistant provincial geologist of Ontario, has returned to Toronto after making a geological reconnaisance of the Kowkash-Tashota gold area.

H. Foster Bain has resigned the editorship of the "Mining Magazine" of London and has been succeeded by **Edward Walker**, previously associate editor of the magazine.

Victor Barndt, of Tonopah, recently visited San Francisco on business connected with the installation of the Solvay process on the Pacific Borax Co. lands at Searles Lake, Calif.

G. Chester Brown, deputy mine inspector of California, has completed official visits in Plumas County, getting out just ahead of the first heavy snow, and is now working in the Oroville region.

Frank H. Sistermans, of El Paso, Tex., is leaving for the southern part of Mexico on behalf of Eastern interests and is expected to be gone some three weeks, after which he will return to his headquarters in El Paso.

W. H. Bischoff, recently at the Saucon Works of the Bethlehem Steel Co., has resigned to become superintendent of coke ovens, blast furnaces and openhearth furnaces of the Dominion Iron and Steel Co., Sydney, Nova Scotia.

J. M. Nelson, formerly with the Algomah Steel Co., Sault Ste. Marie, Ont., has been appointed superintendent of the openhearth department No. 2 Saucon plant of the Bethlehem Steel Co., in place of W. H. Bischoff, resigned.

M. Morino, engineer Imperial Steel Works, Japan, is now in this country to spend a few weeks visiting steel mills and other industrial establishments. He is on his way from London to Tokio, and leaves for Japan from the Pacific Coast on Nov. 24.

Francis P. Sinn, of the New Jersey Zinc Co., Palmerton, Penn., has been elected one of the directors of the National Safety Council, which recently held its fifth annual meeting in Detroit. The organization has created a new section, having to do with safety in copper, lead and zinc smelting.

C. S. Rice, chief mining engineer, and **H. M. Wolfin**, mining engineer, in charge of the Pittsburg station of the U. S. Bureau of Mines, are in San Francisco on a professional visit respecting the appointment of a chief mine inspector of California to succeed Edwin Higgins, whose resignation takes effect at the end of October.

Edwin Higgins, chief mine inspector of California, has returned to San Francisco from an extensive visit in Nevada County. This is his last official visit as inspector. On Nov. 1 he entered upon the duties of sanitary engineer in the employ of the large mines in the Mother Lode region, the Empire at Grass Valley and others.

Charles A. Lemmon has been appointed assistant to Frederick Laist, general manager of the Anaconda Copper Mining Co.'s metallurgical enterprises. He will have charge of all the company's interests in Anaconda, outside the reduction work and the foundry, the last named remaining under the guidance of Chief Engineer Wallace N. Tanner. Mr. Lemmon has been in the company's employ for many years as a civil engineer.

Elliot C. Bacon and **S. W. Eccles** resigned as directors at a recent meeting of the Kennecott Copper Corporation and **John N. Steele** as director and member of the executive committee. Their places were filled by the election of **William C. Potter, H. F. Guggenheim** and **E. A. Guggenheim** as directors, and **William C. Potter** as a member of the executive committee. Mr. Potter was also elected chairman of the board of directors.

E. C. Hutchinson, president and general manager of the Kennedy Mining and Milling Co., and **Henry Malloch**, manager of the South Eureka and Oneida mines, have been almost constantly at the properties in Amador County, California, during the idle period brought on by the labor strike. Managers of other Mother Lode mines affected by the strike are residents of the county or spend most of their time at the mines while in operation.

Edward B. Durham has been supervising the transfer of an aërial tramway from the U. S. Mines at Bingham, Utah, to the Stowell mine, near Kennett, Calif., for the Mammoth Copper Mining Co. The work included the dismantling and shipping of 100 tons of machinery and cables, the designing of new parts and new structures to suit the new site, the framing and erecting of 150,000 ft. of timber for towers and stations, the installing of the machinery and the starting of the plant in operation.

At meetings of the Braden Copper Co. and Braden Copper Mines Co., S. R. Guggenheim, Murry Guggenheim, E. L. Newhouse, J. E. Bamberger, Karl Eilers, Eugene Meyer, Jr., L. Frederick and G. F. Hilton resigned as directors. The vacancies were filled by the election of H. F. Guggenheim, E. A. Guggenheim, H. O. Havemeyer, Stephen Birch, William Pierson Hamilton, Thomas Cochran, Seward Prosser, S. S. Sorensen, and Samuel J. Clarke. William C. Potter was elected president and Stephen Birch and William Pierson Hamilton vice-presidents.

Obituary

Prof. F. H. Robinson, for more than a quarter of a century head of the civil engineering department of Delaware College, died Oct. 17 at his home in Wilmington, Del., aged 66 years. He resigned last spring and in June was elected professor emeritus. Some years ago he was connected with the Edge Moor Iron Works and was also at one time engaged in the engineering business in Wilmington, being a member of the firm of Canby & Robinson.

Societies

American Chemical Society—At a meeting of the New York Section, which will be held at the Chemists' Club, 50 E. 41st St., New York, Nov. 10, the public at large are invited. The program of this meeting will be on the relation of the chemist to our public welfare. The first paper will consist of a discussion of "The General Problem of Public Service Training," which will be handled by Prof. Charles A. Beard, of Columbia University, and of the Training School for Public Service. "The Status and Compensation of the Chemist in Public Service" will be the next paper, which will be presented by Prof. Frederick E. Breithut, of the College of the City of New York. Prof. Breithut, for a number of years, has made a study of the conditions existing in our manufacturing enterprises and will bring home very forcibly the importance of the chemist in public service. The third paper of the evening is "The Chemist in Public Service." This paper will be given by Dr. Harvey W. Wiley, formerly chief chemist, Bureau of Chemistry, U. S. Department of Agriculture. The title of the final paper of the evening will be "The Chemist in the Service of New York City," by Dr. Otto H. Klein, director, Central Testing Laboratory. Dr. Klein's address will be of great interest to people who do not realize to what extent chemistry is entering into the control and government of the city.

Industrial News

The Carbo Corporation has removed its principal office to the factory at Chicago Heights, Ill.

Lawrence E. Coffin, manufacturers' agent, 303 Jefferson County Bank Bldg., Birmingham, Ala., has been appointed agent for the Highland Chemical Co., the Flood City Mfg. Co. and the Dervar Mfg. Co.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Cyaniding Tower. Albert F. Tanner, Greenfield, Wis., assignor to Ideal Continuous Cyaniding Process Co., Davenport, Iowa. (U. S. No. 1,201,386; Oct. 17, 1916.)

Drill Extractor. Harvey Keith MacKenzie, Kimberley, B. C. (U. S. No. 1,202,551; Oct. 24, 1916.)

Drilling—Throttle-Valve for Rock-Drilling Engines. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,201,724; Oct. 17, 1916.)

Electro-Amalgamating Machine. John Ogden, Philadelphia, Penn. (U. S. No. 1,202,006; Oct. 17, 1916.)

Filtering Belt. John M. Callow, Salt Lake City, Utah, assignor to the General Engineering Co., Salt Lake City, Utah. (U. S. No. 1,201,021; Oct. 10, 1916.)

Flotation—Apparatus for Concentrating Ores. John M. Callow, Salt Lake City, Utah, assignor to Metals Recovery Co., Augusta, Me. (U. S. No. 1,201,934; Oct. 17, 1916.)

Hydrometallurgy of Copper. Edward Ray Weidlein, Thompson, Nev., assignor to Metals Research Co., New York, N. Y. (U. S. No. 1,201,899; Oct. 17, 1916.)

Signaling—Improvements in Mine-Shaft Signaling Apparatus. R. S. Scott and J. Wheatley, Dewsbury, Eng. (Brit. No. 3,393 of 1915.)

Slag Pocket for Furnaces. Ernest H. Holzworth, Lowellville, Ohio. (U. S. No. 1,200,839; Oct. 10, 1916.)

Sulphur Recovery — Process for Recovering Elemental Sulphur From Sulphur Gases. W. F. Lamoreaux and C. W. Renwick, Isabella, Tenn. (Brit. No. 2,834 of 1915.)

Sulphuric Acid—Improvements in the Process of Recovering Sulphuric Acid From the Waste Acid of Petroleum Factories. V. C. Coster van Voorhout, Holland. (Brit. No. 12,363 of 1915.)

Tunneling Machine. Olin S. Proctor, New York, N. Y., assignor to the Rock Tunnelling Machine Co., Inc., New York, N. Y. (U. S. No. 1,201,097; Oct. 10, 1916.)

Tuyere. Harry E. Zeigler, Carlisle, Penn., assignor of one-third to John H. Rupert and one-third to Benjamin H. Snyder, Carlisle, Penn. (U. S. No. 1,201,130; Oct. 10, 1916.)

Sintering Machine. Sophus P. C. Borson, Salida, Colo. (U. S. No. 1,199,962; Oct. 3, 1916.)

Zinc-Gold Slimes—Improvements in the Treatment of Zinc-Gold Slimes. J. Penhale, Johannesburg, Transvaal, So. Afr. (Brit. No. 14,921 of 1915.)

Assessments

Company	Delinq.	Sale	Amt.
Alpha, Nev.	Oct. 25	Nov. 15	$0.03
Andes, Nev.	Oct. 11	Nov. 1	0.02
Big Cottonwood, Utah	Nov. 6	Nov. 24	0.01
Blue Bell, Ida.	Oct. 9	Nov. 9	0.002
Blue Bull, Nev.	Oct. 16	Nov. 20	0.01
Blue Star, Ida.	Sept. 25	Nov. 21	0.02
Cedar Creek, Ida.	Oct. 23	Nov. 23	0.01
Chief Cons. Ext., Utah	Oct. 10	Nov. 1	0.002
Columbus-Rexall, Utah	Oct. 27	Nov. 17	0.02
Confidence Silver, Nev.	Nov. 8	Nov. 29	0.10
Cornet, Ida.	Oct. 20	Nov. 20	0.00075
Consolidated Imperial, Nev.	Oct. 25	Nov. 15	0.01
Demijohn, Utah	Oct. 21	Nov. 10	0.005
Diam. Blk., Butte, Nev.	Oct. 12	Nov. 18	0.01
Diamondfield Bl'k B'tte, Nev.	Oct. 12	Nov. 18	0.01
Duluth, Ida.	Oct. 18	Nov. 18	0.001
Eagle Mountain, Ida.	Oct. 2	Nov. 4	0.001
Emerald, Utah	Oct. 16	Nov. 18	0.00½
Emerald, Utah	Nov. 15	Dec. 9	0.00½
Enterprise, Ida.	Oct. 19	Nov. 20	0.002
Four Timber, Ida.	Oct. 1	Nov. 1	0.002
Friend, Ida.	Oct. 21	Nov. 24	0.002
Giant, Ida.	Oct. 5	Nov. 9	0.003
Hale and Norcross, Nev.	Nov. 8	Nov. 29	0.03
Idaho & L. A., Ida.	Oct. 16	Nov. 17	0.005
Idaho Mont, Ida.	Oct. 30	Nov. 18	0.002
Independent, Ida.	Oct. 7	Nov. 7	0.005
Lehi Tintic, Utah	Nov. 8	Dec. 2	0.0025
Manhattan Cons., Nev.	Oct. 9	Nov. 8	0.01
Military, Ida.	Oct. 25	Nov. 25	0.00025
Mineral Range Gold, Utah	Oct. 16	Nov. 8	0.005
Monarch-Pgh., Nev.	Oct. 23	Nov. 27	0.01
Murray Copper, Utah	Oct. 9	Nov. 8	0.001
Naildriver, Utah	Nov. 4	Dec. 4	0.01
Native Silver, Mont.	Oct. 2	Nov. 4	0.005
Ninemile, Ida.	Nov. 2	Nov. 17	0.0015
Nonpareil, Ida.	Oct. 23	Nov. 22	0.001
North Cliff, Utah	Oct. 10	Nov. 3	0.01
North Franklin, Ida.	June 19	Nov. 23	0.005
North Tintic, Utah	Oct. 10	Nov. 1	0.002
Ophir, Nev.	Oct. 25	Nov. 15	0.05
Raven, Ida.	Oct. 23	Nov. 20	0.001
Sec. Belcher & Midas, Nev.	Oct. 30	Nov. 24	0.02
Selma, Utah	Nov. 4	Nov. 23	0.005
Sierra Nevada, Nev.	Oct. 12	Nov. 2	0.10
Silver Mt., Ida.	Oct. 21	Nov. 24	0.002
Spearhead, Nev.	Oct. 2	Nov. 2	0.01
Tobar, Utah	Nov. 2	Nov. 23	0.002
Tyler, Ida.	Oct. 12	Nov. 13	0.0015
Utah Arizona, Ariz.	Oct. 31	Nov. 25	0.005
Utah Metals, Utah	Oct. 23	Nov. 18	0.002
Wasatch Marble, Utah	Sept. 26	Nov. 11	0.03
Zuma, Utah	Oct. 30	Nov. 30	0.005

Editorial Correspondence

SAN FRANCISCO—Oct. 28

Petroleum Production in California in September totaled 7,965,420 bbl. Shipments from the fields totaled 9,214,358 bbl. Crude stocks at Sept. 30 aggregated 48,469,257 bbl. Producing wells in 11 fields totaled 7,170, of which 1,859 were in Kern River and 1,659 in Midway-Sunset. All other fields had less than 1,000 wells. Coalinga had 925, Los Angeles and Salt Lake, 674, and Whittier-Fullerton, 647; the other 6 fields had less than 500 each.

First Snow of the Present Season fell in the Sierras at the beginning of October. The first precipitation was light on the ranges east and west of the Sierras, followed by rain and wind and extreme cold. Then a heavier snow fell in all the Sierra region and actual winter weather set in a month earlier than is usual in California. Light snow, followed by bright days and delightful traveling weather, is common in early October. The mines take advantage of October to put in their late supplies, make a general cleanup about the surface plants and set everything in order for the winter. During the past month of October, both the miners and the cattlemen believed there would be fine weather following the first flurry of snow. But the storm gave them no time for leisurely movement. Large amounts of mine supplies were stalled and thousands of cattle and horses were snowed in and many of them perished. Some compensation is found in the fact that an unusually large amount of snow packed into the gulches and cañons will provide water for power and other mining and agricultural purposes in the summer.

Randsburg is Recovering from the slump in gold mining, which followed the recent boom in tungsten when the three camps of Randsburg, Johannesburg and Atolia had an influx of additional population that totaled nearly 3,000, two-thirds of whom were settled in and about Atolia. New dwelling houses were built in both Atolia and Randsburg and hundreds of tents were pitched between and along the line of the scheelite deposits. Everyone was apparently making money, but only apparently. Everyone was busy and a few made a great deal of money, in comparison to the amounts invested and the labor performed. Three men made approximately $100,000 each. Others went broke. Numerous owners of tungsten ground are holding on until the industry becomes settled, and the prospects are good for reasonable profit upon development and operation. The decline in price of tungsten from $75 to $30 and the dullness of the market made the business unattractive and when the price went below $30, even high-graders and ore thieves, who flourished for a while and helped to keep the camps wide open, vamosed. During the period of the tungsten boom the gold miners and leasers, and even owners, neglected the gold mines. And when the bottom dropped out, the more industrious got back to work and the prospects are fair for the reopening of the gold properties and maintaining the reputation of Randsburg as the greatest gold camp in southern California. The Yellow Aster, of course, was unaffected by the tungsten boom. The Atolia Mining Co. was greatly benefited, and even since the slump has been running the mill one 8-hr. shift in 24 hr. and sinking a new shaft. There are still a few individual miners producing tungsten. So altogether the region is still alive and on the map.

Mother Lode Striking Miners in Amador County are still out and are likely to remain so awhile. Unwarranted disturbance and effort to prevent one of the engineers of the South Eureka from going to his work have deprived the strikers of what little sympathy they had from the public and the newspapers. Injunctions were granted by the U. S. District Court at San Francisco against 28 of the strikers, enjoining them from committing violence and interfering with men desirous of resuming work in the Argonaut, Kennedy, South Eureka, Central Eureka, Bunker Hill and Fremont mines. John A. Kelly, deputy state labor commissioner and former president of the San Francisco Labor Council and member of the Machinists' Union of San Francisco, was ordered to show cause why he should not be enjoined from interfering with the operation of the mines. The mine owners and operators have given out no statements for publicity regarding the present status of the strike or their attitude toward the strikers and other miners interested. But it is not at all improbable that all of the mines closed down would begin operating immediately if the miners who were not responsible for, and not directly engaged in the strike, would make application for work. There is one thing quite certain, that the demand made by the strikers will not be granted. It is stated on fairly good authority, but the statement has not been admitted by the mine owners, that it was the intention of the owners and operators of all the mines affected by this strike to have increased the wages in January, 1917. One thing should be held in mind in connection with the refusal to consider a present demand for increased wages—each of these mines has within the past year been making improvements for the betterment of the condition of the men and for increasing the capacity of the property. This means a larger total number of men to be employed in 1917 and greater protection and increased comfort for the men themselves. But many of the men who brought about the strike are not inclined to appreciate anything that is done for their benefit or that leads to the employment of additional men. It is claimed by the strikers that they do not demand recognition of the union, although they are asking for a meeting of mine owners with the union for the purpose of arbitrating, and are demanding that no discrimination be shown when members of the union report for work. While there is no chance that the employers will recognize the union as an organization, they will not reject men who belong to the union, provided their action not only in the present trouble but their position prior to the strike is satisfactory. In other words, it is well understood that the mine owners and operators on the Mother Lode in Amador County will not permit any labor union or any set of men to conduct their business for them.

BUTTE—Oct. 28

Davis-Daly Will Break Even on operations for the current quarter. The previous quarter showed the usual deficit, amounting to $8,117. The management hopes to have the new hoisting engine in place by the first of the year, when the output may be doubled.

North Butte Property looks better today than it has in some years. Some excellent orebodies have been opened in the northern section of the property and one vein is yielding ore assaying 10% copper and 30 oz. silver to the ton. Fair progress is also being made in the development work on the east side properties owned by the company, and the discovery of a large vein of sulphide ore in adjoining property is considered one of the very hopeful indications.

Anaconda Zinc Plant at Great Falls far exceeds in its results the estimated capacity. Two of the five units have been in operation for some time. They were built for a theoretical output of 50 tons of zinc per day, but the actual output has been 60 tons for the two units, and have been working with entire satisfaction. There has been an unexpected delay in the delivery of some of the heavy electrical machinery, but the manufacturers have promised to hurry the work and it expected that the entire plant will be equipped and in operation by the first of the coming year.

A Road from Darby to Mineral Hill is being urged for the Mineral Hill District of Ravalli County. Under leadership of I. Freimuth, of Duluth, efforts are being made to induce county officials to put county road into shape for motor-truck transportation to permit profitable exploitation of many promising mines in that district. Mr. Freimuth and associates have developed the Lent mine, near Alta, to a point where shipments of rich copper ore may be started as soon as roads are in condition. It is planed to build a concentrator at the mine to treat the lower-grade ore, of which, it is reported, large bodies have been opened up. All this is dependent on the building of the road, as without satisfactory transportation facilities the working of the mines in the district would not be profitable.

Butte & Superior Production of mine and mill for the first half of October is considerably larger than for the corresponding period in September. If the last half of the month makes as good a showing, the total amount of ore taken out at the Blackrock for October will reach 55,000 tons as against a tonnage of 50,150 tons in September. The concentrates record will pass the 15,000-ton mark as against 13,650 tons in September, while the production of zinc in concentrates will go above 16,000,000 lb. as against a little less than 15,000,000 lb. last month. Work on the No. 2 shaft, the smaller of the new ones, has been suspended. This shaft has a depth from the surface of 675 ft. and it also has three raises of 100 ft. each complete from lower levels. Work there will depend on the waste requirements. When additional quantities of waste can be used, additional raising will be carried on. The No. 3 shaft, the large new one, is now awaiting equipment. It is completely timbered to the 1,500-ft. level and is being used with a small hoist for the lowering and raising of men and supplies. It will probably be Jan. 1 before the new equipment is on the ground and work of installing it begun.

In Elkhorn Mining District the arrival of the power line installed by East Butte company in connection with that of the Montana Power company is expected to make possible the profitable exploitation of many of the mines in the district that have lain idle for years, due to the absence of cheap power. The East Butte company, of Butte, is shipping from its mine in the Elkhorn district considerable iron ore to various smelters, where it is used for fluxing. The ore is said to contain besides the iron considerable quantities of gold. At the Rothfuss-Dickmann properties, a 10-stamp mill will be operated by electric power within a short time, to treat the output from the Montana and Dalcoast claims, where big bodies of ore have been blocked out. It is reported that the old Elkhorn mine and three large tailings dumps, comprising 250,000 tons, assaying from $2.50 to $15 gold, have been sold to Walker interests of Salt Lake, who will commence operations by the first of the year. At the Elkhorn-Bulwer property, development work is under way, which has opened up a body of copper ore averaging from 10 to 15% copper. At the Calumet, Elkhorn Queen and Golden Moss claims, all in the same district, preparations are being made to resume operations, made possible by the introduction into the camp of electric power.

Results of "Safety-First" Work in Butte Mines are encouraging. The accident record in the mines of the Anaconda Copper Co. for the month of August was the best since the inauguration of this work. Of the company's 27 mines, 13 did not have a single accident. For a total number of 334,469 shifts, the total number of accidents was 23. Notwithstanding the fact that 21 men were suffocated in the Pennsylvania mine fire of Feb. 24, a reduction of 23% has been made in the fatal and serious accidents during the first half of 1916. One of the chief reasons for this reduction is the fact that the foremen and shiftbosses of the various mines are in hearty coöperation with the officials of the "safety-first" department and are making constant efforts to educate the men under their supervision in taking care of themselves as well as of their fellow workers. The general rule now is to do things the safest instead of the easiest way, as was the practice heretofore, with the result that as much work is accomplished with a minimum of accidents.

GARY, IND.—Oct. 28

The New $5,000,000 Tinplate Mill turned out its first product on Oct 16. Construction was begun only last December, which makes as good a record as the Donora construction. These mills employ 2,000 men and have a payroll of $10,000 per diem.

SALT LAKE CITY—Oct. 27

Utah Copper Stock at $100.50, as recorded by New York sales, constitutes a new high-price record. Dividends started in 1908 with $1 per share, increased to $2 in 1909, climbed to $3 in 1910 and staid there till 1915 when $4.50 per share was paid. In 1916 the dividend is $8.50 per share. Dividends paid to date total $46,476,000 on 1,624,490 shares outstanding. Distributions in 1916 total $13,809,000—truly a remarkable record.

The Utah Apex Mining Co., of Bingham, recently filed an answer to the suit brought against it by the Utah Lead and Copper Co. The plaintiff alleged that the defendant had wrongfully entered its Susquehanna and Venice North Extension lode mining claims, and extracted ore to the value of $10,000. The answer denies that the Utah Apex has ever wrongfully entered upon such property or that it has ever appropriated ore of great or little value, or that it has ever threatened to encroach upon the property of the plaintiff, or that it intends to do so.

Utah Agricultural College Experiments recently made to determine the possibility of obtaining potash in commercial quantity from the ash of sage brush have attracted considerable interest. The investigation has been carried on under the direction of Professor C. T. Hirst and Professor E. G. Carter. Experiments are reported to show that a ton of sage brush ash contains from 82 to 275 lb. of potassium salt. There is talk of building a plant to treat sage-brush ash in this section.

American Fork District Mines and prospects which are expected to continue operations throughout the winter are: The Pacific, working 30 men; Dutchman, 15 men; Miller Hill Exploration, 8 men; Mineral Flat, Texan, Belerophon, Red Cloud, South Park, Bay State, Whirlwind, Earl-Eagle, Gold Hill, Major Evans and Silver Dipper. Other mines and prospects will work until the first snow. Power lines have been strung up the cañon as far as the Pacific, which will use electric power in both mine and mill. Telephone connections have been made with various mines. There is more activity in the camp than at any time in 10 years.

DULUTH, MINN.—Oct. 30

Oliver Iron Mining Co. has announced that the Missabe Mountain property at Virginia will be stripped immediately. Fee to this property is owned by the State of Minnesota. While the area is 160 acres, only 80 are underlain by ore.

Northern Pacific Ry. will build a 600-ft. addition to its dock at Superior, Wis. The addition will be constructed of steel and concrete. The ore yards adjacent to the dock will also be enlarged. The dock, which receives only Cuyuna Range ore, will handle about 400,000 tons this season but anticipates shipments of at least 1,000,000 tons next year.

SPOKANE, WASH.—Oct. 28

Snowstorm Mines Construction Work and development is inducing activity among other companies operating in the region surrounding Troy, Mont. The district is reported to be the center of greater operations than at any time in its history. A large number of men are employed at the different properties and supplies and equipment are being sent in by the train load. The attention of investors is being attracted to the district, and engineers are scouring the country in search of promising holdings for sale. The Togo company, Ralph Smith and Robert Larter, owners, has started a tunnel now in 200 ft., and will be continued 600 ft. to reach an orebody that is 2 ft. wide at the surface and contains high-grade silver-lead ore and no zinc. Some of the ore runs 400 oz. silver to the ton. The construction of a flume to carry water to drive a compressor is nearly completed. Cabins and a road are being built by the L. & V. Mining Co., a Spokane corporation, in preparation for development throughout the winter. The property is a northerly extension of the vein system of the Big Eight, owned by Harry L. Day, of Wallace, and of the Snowstorm. The Silver Tip company, owned by Robbins & Wright, of Spokane, has let a $9,000 contract for 900 ft. of crosscutting that is expected to reach the vein at a depth of 600 ft. The shoot contains silver, lead and zinc. J. H. Ehlers, identified with the Sylvanite, a gold property, 20 mi. north of Troy, reports that operations to be started this fall will proceed through the winter. The company has ordered a carload of horses to haul lumber for the establishment of a large camp. Winter quarters have been completed by the Montana Morning, and drifting is in progress. The property is comprised of 12 claims, traversed by three parallel leads opened by several hundred feet of tunnel and two shafts. All of the veins show good assays in silver, lead and zinc. Development is being directed by William Hogan, of Spokane, who, with Bud Woods, of Troy, is the chief owner. The Snowstorm railroad crosses the north end of the group.

PHILADELPHIA, PENN.—Oct. 30

Wharton Steel Co. Iron Ore Tract—about 5,000 acres at Wharton, N. J.—is reported by the "New York Times" bought by J. Leonard Replogle, vice-president of the American Vanadium Co. The deal was made by representatives of the estate of the late Joseph Wharton and by Ernest Hillman, of J. H. Hillman & Co., of Pittsburgh. The purchase involved $10,000,000 worth of capital stock, all owned by the Wharton estate. It is reported that a corps of engineers will soon begin drill testing of the tract at Wharton to determine the actual quantity of ore reputed to be about 60,000,000 tons of magnetite ore. It is reported that expenditures running into the millions are contemplated for additions and improvements to the company plants.

JOPLIN, MO.—Oct. 28

Regular Presidential Election Furor over the question of a zinc-ore tariff is now in evidence. Democrats argue that a high tariff not only is not consistent with ideas of a big trade with foreign nations, but also that it would not help this section materially. Republicans argue that it would help definitely and declare zinc-ore prices are likely to go very low unless we are protected from Mexican zinc ore importations.

TORONTO—Oct. 26

A Party of Investors, including about 25 Canadians and Americans, mining engineers and others, including Gordon Crean, president, and E. A. Snowman, a director of the Davidson mine, left Toronto recently on a trip of inspection to the Porcupine camp and more especially to examine the Davidson.

The University of Manitoba, at Winnipeg, recognizing the growing importance of the mining industries of the province, recently opened a course of lectures in connection with its department of geology and mineralogy for the benefit of prospectors and miners. The course will embrace lectures on minerals, mining and prospecting, with practical work on minerals and their determination and also on fire assaying for which a laboratory has been fitted up.

War Tax Effect on the Mines is still an unknown quantity, the only mine so far that has had the matter settled being the Seneca Superior, which paid $15,000. This mine has since been closed down. The uncertainty is having a detrimental effect upon investors and upon the mining stocks. The government is much at fault for allowing this uncertainty to continue, as it is doing a great deal of harm to the industry. The tax which affects all companies in Canada having a capital of $50,000 or over, calls for 25% of the profits over 7%; that is, 7% would be allowed on the capital and the tax would amount to 25% of the profits over that amount. In the case of mining companies, however, it was stated that on account of the dividends being paid from the real capital, special consideration would be given to this industry, but so far no definite announcement has been made. It is understood that in the case of precious metal mines, the capital will be computed on the basis of five years' profits, and that depreciation at the rate of 10% a year will be allowed, and this will be deducted from the yearly profits before allowing the 25% tax on excess profits. To take a concrete example, the Dome profits may be taken at roughly $1,000,000. Capital based on five years' profits would be $5,000,000. The depreciation would be $500,000 and the 7% allowed on the $5,000,000 capital would be $350,000, or a total deduction of $850,000 from the $1,000,000 profits. The tax would therefore be 25% of $150,000, or $37,500. If this is correct, it is believed no exception would be taken to it, and there would be no further reason for timidity by the American investor in Canadian mining ventures. Such a tax would be no hardship and would in fact be so small that it would hardly be felt. It is, however, high time that a definite official announcement was made by the government on this important question, and the mining companies should no longer be left in the state of uncertainty now existing.

LONDON, E. C.—Oct. 28

Stratton's Independence, Ltd., recently held an extraordinary general meeting in London at which a momentous decision was reached. A resolution submitted authorizing the directors to participate in a Russian mining enterprise was lost—26 votes against and 17 in favor of the resolution. Having sold its famous Cripple Creek, Colo., mine some time ago, the directors will now take the necessary steps to place the company in voluntary liquidation forthwith.

The Mining News

ALASKA

ALASKA MINES CORPORATION (Nome)—Drill testing begun on 222 acres newly added to 1,860-acre former holdings. Tests on latter reported developed 165,000,000 cu.yd. averaging 37c. per yd. Estimated dredging cost, 13c. per yd.

ARIZONA

Gila County

MIAMI CONSOLIDATED (Miami)—Company well financed preparatory to development campaign. Property includes 62 claims embracing over 200 contiguous acres. Two churn drills ordered; double-compartment shaft sinking.

Mohave County

ARIZONA BUTTE (Oatman)—Reported shipping concentrates averaging $125 per ton. Driving tunnel to cut vein at minimum depth of 600 ft.

CRESCENT (Oatman)—Tunnel driven 500 ft. into formation changed from andesite to calcite probably indicating approach of vein. George Peirce, manager.

TOM REED (Oatman)—Important strike made at 400-ft. depth on Bald Eagle claim believed to extend known length of Aztec-Black Eagle vein by 2,000 ft. Locally believed vein may develop into greater mine than original Tom Reed workings on Ben Harrison claim.

BIG JIM (Oatman)—Reported crosscut ore 29 ft. thick assaying $8 per ton on 240-ft. level. Six crosscuts on 400- and 465-ft. levels all show over 26-ft. width ore assaying over $7 per ton exclusive of high-grade streaks. Orebody now developed over 700 ft. long and estimated about 500,000 tons blocked out.

UNITED EASTERN (Oatman)—Two-hundred-ton mill under construction will have crushing capacity 400 tons, cyaniding capacity 200 tons daily. Capacity thus easily enlarged by addition to cyanide department. Crushing done by Marcy and pebble mills; cyaniding done with continuous counter-current system.

Pinal County

MAGMA COPPER (Superior)—Reported strike of 21-ft. width ore averaging 9.8% copper on 1,500-ft. level resulted in sensational performance of stock market. First unit of zinc concentrator about completed.

Yavapai County

UNITED VERDE (Jerome)—Reported that steam-shovel operations will be introduced to mine low-grade copper ore northwest old smelter site. Louis S. Cates, manager Ray Consolidated, recently visited Jerome at company invitation to advise preliminary engineering work.

ARIZONA EXTENSION RAILROAD recently incorporated, with James S. Douglas, president, and directorate including E. O. Ellis, James P. Boyle, H. W. Williams, and S. P. Applewhite. Proposes building railroad from Clarkdale to Mesa running down Verde Valley and connecting with Jerome by 7-mi. branch line.

CALIFORNIA

Amador County

MIDDLE BAR (Jackson)—Surveyor Downs making survey preparatory to reopening.

HARDENBERG (Jackson)—Unwatering shaft and stopes below 600 level. W. J. Loring, manager.

LUCKY STRIKE (Pine Grove)—This and the De Soto, recently bonded to L. E. Bedford by F. A. Kimball, said to have been sold to Herbert Carmichael, of San Francisco. New hoist and compressor will be installed at 120-ft. shaft.

PLYMOUTH CONSOLIDATED (Plymouth)—In September tons of ore milled, 6,900; value, $44,621; total working expense, $25,352; total development, $6,717; surplus, $12,552; other capital expended, $8,628. Continuous operation of mine since reopening has induced reopening of other properties and caused numerous improvements in town.

Calaveras County

ANGELS DEEP (Angels Camp)—Foundations completed for compressor.

SULLIVAN (Mokelumne Hill)—M. J. Windler, manager of Mokelumne group, has taken bond and started development.

Kern County

WERINGER MINES (Woody)—Construction started on 100-ton flotation mill. Installation will include 200-hp. Western gas engine, 125-kw. Electrical Machinery Co. generator, Hardinge mill and K. & K. flotation cells.

CONSOLIDATED (Randsburg)—Recent disclosure of new $40 ore encourages resumption of milling. Wedge shaft still producing water steadily, company disposing of about 1,000,000 gal. per month. Seth Tyler, superintendent.

Mariposa County

MARIPOSA GRANT is again under inspection by mining engineers E. H. Benjamin and Fred L. Morris, who accompanied Alden Anderson, Herbert Fleishacker, Mark Gerstle, Dr. Washington Dodge, A. Abrahamson, of San Francisco, on recent visit.

Placer County

RAWHIDE (Dutch Flat)—Mine reopened after two years' idleness by Cañon Mines Co. H. J. Sisty, of San Francisco, consulting engineer; employs 15 men.

Plumas County

ENGELS COPPER (Keddie)—For first six months' operation in 1916, gross earnings, $475,578; operating expenses, $249,454. Net income equal to more than 30% of par value of stock issued and 10% of the market value estimated on annual basis. Proposed to increase stock from $1,500,000 to $2,000,000. Mine and mill employ 300 men. Sufficient ore blocked out to insure 500 tons a day.

San Bernardino County

ATOLIA (Atolia)—The 100-ton mill running one 8-hr. shift every 24 hr. Few individual operators are mining scheelite in the Atolia district.

AMERICAN TRONA (Trona)—New mill operating, using Solvay process for extraction of potash and other products from Searles Lake brine. Old mill stands on lands controlled by Pacific Borax Co., who, it is reported, will install new mill on old site and also adopt Solvay process. Lands of borax company have no part in litigation pending regarding ownership of Searles Lake deposits.

Shasta County

YANKEE JOHN (Redding)—Reported that single shot disclosed pocket producing $1,500.

MAMMOTH (Kennett)—Stowell aërial tram completed and first shipment of ore to smeltery made recently. Tram operated between the Stowell and the Balaklala. Ore transferred to Balaklala tram, thence to railroad at Coram for transportation to Kennett.

NOBLE ELECTRIC STEEL (Heroult)—Three smelting furnaces reported operating continu-

ally to capacity producing manganese, chrome and silica. Ore supplied from San Benito, Shasta, Alameda and Mendocino Counties. Company developing chromic iron in Siskiyou County. Contract reported for shipment East of 250 tons ferromanganese per month until next May. Company employs 120 men. W. W. Clark, superintendent.

Tuolumne County

CONFIDENCE GOLD (Sonora)—Reported to have purchased from Herbert L. Rothchild, of San Francisco, Confidence group of claims and mill site and other adjoining properties. Property recently redeemed from state tax. Edward W. Jassen, manager.

COLORADO

Boulder County

CASH (Magnolia)—Will be reopened and developed under leasing system. Air compressor and machine drills installed.

PRUSSIAN (Boulder)—Development resumed under management Frank Tarbet. Remodeled mill in operation on ore mined from development and low-grade in old stopes.

Clear Creek County

MIXELL MILL (Idaho Springs)—Plant leased by E. J. Jones and will be operated as custom mill.

WYOMING VALLEY (Idaho Springs)—Tunnel recently advanced 100 ft. will be advanced additional 100 ft. by contractors Chapman & Smith. Tunnel within 200 ft. of Niagara vein.

SILVER HORN (Idaho Springs)—Has been secured under bond and lease by F. B. Wall, of New York. New plant of mining machinery will be installed and systematic underground development pushed. F. B. Hall, Jr., superintendent.

PHILADELPHIA (Georgetown)—Will reopen Hamill property on north slope of McClelland Mountain. The crosscut tunnel now in 700 ft. will be advanced and additional development done. Additional mining equipment will be purchased.

DENBIGH SILVER-LEAD MINES (Georgetown)—New organization incorporated by B. C. Catron, Jr., E. J. Nichols and J. T. Garrett, with a capital of $1,000,000, divided into 200,000 shares of $5 par value. Company will acquire and develop mining properties in Clear Creek County.

San Miguel County

GERTRUDE (Telluride)—Being developed by King & Farrell, driving drift on Modena vein with air drills.

BLACK BEAR (Telluride)—The 450-ft. shaft being widened to increase capacity. Electrically operated skip will be installed. Ore transported to Smuggler-Union mills, where 20 stamps are kept busy.

San Juan County

MAYFLOWER (Silverton)—Large pocket high-grade gold ore struck by Slattery & Mears.

BIG THREE (Silverton)—Active development pushed under direction of owner, E. J. Holman.

GREEN MOUNTAIN (Silverton)—Flotation equipment being installed in Cunningham Gulch mill.

NORTH STAR (Silverton)—Mill completely overhauled under direction of L. O. Bastion and now operating.

TOM TURNER (Silverton)—Lease secured by B. B. Allen and C. Fattor, who are installing mining equipment.

ELK (Silverton)—Being developed under direction of J. J. Cusick and has struck body of low-grade copper.

DORA (Silverton)—Contract to sink main shaft awarded to Clay Johnson and work under way with three shifts. During October, 10 cars ore shipped to Durango smeltery. E. P. Ricker, manager.

KLONDIKE (Silverton)—Recently purchased from Peter Carlson by R. E. L. Townsend and associates. Several mine buildings erected and new mining equipment installed. Small force engaged underground in development will be increased soon. Peter Carlson, superintendent.

CONNECTICUT

LANTERN HILL (Norwich)—This old silex mine to be reopened by New York men. Old grinding mill at Essex will be rebuilt and railroad siding laid.

IDAHO

Shoshone County

CALEDONIA (Kellogg)—President Stanley A. Easton reports September earnings at about $100,000 or about $10,000 more than for August. Search for faulted orebody continued from Keating tunnel.

REX CONSOLIDATED (Wallace)—Mill operation delayed by nondelivery of aërial tramway buckets. Official report gives available tonnage sufficient for 12 months mill supply 200 tons daily.

HIGHLAND-SURPRISE (Kellogg)—Important new orebodies opened by development. Concentrator producing 20 to 22 tons daily high-grade concentrates. Will install additional equipment to increase output. W. W. Papesh, manager.

AMERICAN COMMANDER (Mullan)—Tunnel cut stringers thought to indicate approach to orebody. Surface exploration developed orebody 20 to 40 ft. wide, 135 ft. long in which orestreaks carried up to 60 oz. silver besides galena and carbonates.

HECLA (Burke)—Development east vein exposed orebody 850 ft. long thought continuous 1,500 ft. high. No. 3 tunnel proved length from which 600 ft. upraise made on ore. Latest strike of 4-ft. solid galena orebody made on 900-ft. level, 900 ft. below tunnel thought same orebody. Mine reserves reported practically doubled.

MICHIGAN

Copper

MAYFLOWER (Calumet)—Diamond drill exploratory work attended by success. Bad faulting of lode has resulted in problems but lodes now correlated.

VICTORIA (Victoria)—Sinking at shaft will be resumed soon as second skipway completed. Extensive exploratory work, in addition to mining, being outlined.

CALUMET & HECLA (Calumet)—No. 1 regrinding plant, formerly equipped with old-style chilean mills, is to have Hardinge mills for regrinding sands. Each conical mill installed will replace two chilean mills.

FRANKLIN (Demmon)—Operating costs reported reduced from 21c. per lb. copper last January to 15½c. recently. Monthly production about 270,000 lb. Production for first eight months 1916 exceeds by 665,000 lb. entire 1915 production.

NEW ARCADIAN (Houghton)—Development progressing and station cut at 1,500-ft. level; drifts will be pushed east and west. At No. 2 shaft, drifts working north and south on veins show mineralization, but have not penetrated lode far enough to give much data.

KEWEENAW COPPER (Phoenix)—One stamp head working rock from mine stock pile but no official statements made as to how rich rock will average. Mining to be resumed immediately, will consist of drifting at sixth, tenth, twelfth and fourteenth levels.

MISSOURI

Joplin District

CLERMONT (Galena, Kan.)—Resumed operations after several months shutdown.

LANGFORD & SCAFE (Joplin)—Drilling five tracts near Cardin. W. J. Scafe, Joplin, manager.

GOLDEN ROD (Commerce, Okla.)—About completed erection old Cramer mill, formerly at Cave Springs, upon lease near Cardin.

DAISY BELL (Aurora)—This and Aurora Consolidated installing electric equipment. Red Wasp installing own electric lighting plant.

C. S. & P. (Joplin)—Sinking new shaft on lease near Belville and penetrated 15 ft. rich dirt in soft ground. LeRoy Clayton, Joplin, manager.

MISSOURI MINES (Joplin)—Having good success operating old Quick Seven property at Alba as openpit property. Developed face pay dirt 145 ft. thick.

32ND PROSPECTING (Lincolnville, Kan.)—Reports good drill strikes on old Mission tract at level lower than formerly mined. Will drill other holes and develop.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Wise River)—Spain mine, in French Gulch, closed down for winter and 35 men laid off. Heavy snowfall prevents ore transportation to Washoe smeltery. Operations will be resumed later.

Jefferson County

BOSTON & CORBIN (Corbin)—Flotation results attracting attention. Unit treats tailings from concentrator, running about ¾% copper and makes concentrate carrying 13.4% copper and 9.9 oz. silver. Concentrator treated during October about 100 tons per day. Expected that further improvements will increase both capacity and recovery.

Lewis and Clark County

SCRATCH GRAVEL (Helena)—Announced strike made in shaft at depth of 250 ft. of vein from 8 to 30 in. wide, carrying 70% lead, 80 oz. silver and $12 gold per ton. Alongside of galena, oxide of iron occurs, carrying from 3 to 40 oz. gold. Ore being sacked for shipment to smeltery. Five distinct veins exposed, expected to merge into one at depth. Further strikes of high-grade ore, assaying hundreds of dollars per ton, have caused rush into district.

Mineral County

TARBOX (Saltese)—Will start ore shipments Jan. 1, 1917. Shaft down nearly 600 ft., where station will be cut, pumping equipment installed, and crosscut run about 180 ft. to strike vein. Power drills and compressor plant recently installed. Mine buildings under construction.

INTERMOUNTAIN MINING (Superior)—Operations netting about $17,000 per month. About 15 cars ore and concentrates shipped per month from which smelter returns amount to between $1,800 and $2,000 per car, while operating expenses approximate $6,000 per month. New oreshoots found which will materially add to company's ore reserves. Copper contents are from 2½ to 10% per ton.

Missoula County

ROYAL MINING CO. (Clinton)—Recently incorporated to work Charcoal mine near Clinton on Northern Pacific Ry. Machinery to be installed to sink to 400 level. Charcoal vein 4 ft. wide with 2 ft. paystreak, carrying high values in gold and silver.

Silver Bow County

BUTTE & SUPERIOR (Butte)—September report filed in compliance with orders incident to Minerals Separation Co. litigation shows flotation section of mill treated 48,810 tons, resulting in 12,694 tons concentrates, valued at $48.69 a ton; cost of flotation, $3.17 per ton concentrates.

GREAT BUTTE COPPER (Butte)—Completing surface plant preliminary to beginning active operations. Shaft unwatered to 230 ft. and timbers found in good condition. When completed, company expects to do considerable development on property, heretofore known as Butte & Bacorn holdings in northern section of district.

EAST BUTTE EXTENSION (Butte)—Leasers on company's property recently shipped car of 32 tons copper ore, netting $1,854. Ore assayed close to 10% copper. Another 50-ton shipment will soon be made assaying 6% copper. Company plans sinking No. 6 shaft from present bottom level at 240 ft. to 800 ft., where crosscutting will be started.

EAST BUTTE (Butte)—Recent shipment of 44 cars copper started rumors of dividend to be paid stockholders before end of year. Upon payment for shipment, company will have more than $1,500,000 cash which, it is expected, directors will consider ample to pay dividend and retain funds to carry on current work. September production showed slight falling off from preceeding month, but total production for nine months amounted to 13,803,000 lb. copper.

NORTH BUTTE (Butte)—In quarter ended Sept. 30, produced 5,954,685 lb. copper or close to average of 2,000,000 lb. a month. Silver production amounted to 247,833 oz. and gold to 4,000 oz. Surplus and reserve Sept. 30, $4,789,360, showing increase over $900,000 in nine months, in addition to increase of dividend rate. Predicted that by Jan. 1 surplus will be above $5,000,000 mark. Profit for quarter was $587,424, for first nine months more than $1,600,000.

ANACONDA COPPER (Butte)—Recent development on 2,800 level of Leonard mine opened up high-grade ore, said to be 20 ft. wide and assaying 6¾% copper. Orebody, so far as known, not opened anywhere else in mine, so exploration on other levels may encounter new lead and add to ore reserves. From Douglas mine, in Coeur d'Alene district, Idaho, operated under lease and bond, reported that preparations being made for ore shipments to zinc plants at Anaconda and Great Falls. Large amounts zinc ore on dump and in mine ready to be stoped soon as shipments can be undertaken. To provide for heavy freight and ore traffic on Butte, Anaconda & Pacific Ry. six new electric engines and 200 steel dump cars ordered. Several old steam engines temporarily put in commission to take care of increased traffic.

NEVADA

Esmeralda County

LOU DILLON (Goldfield)—As result of core drilling west of Columbia Mountain fault, plans under way to reorganize company.

SPEARHEAD (Goldfield)—Shaft down 850 ft. New 1,400-ft. cable installed and sinking will continue to latite-shale contact. Northerly drift being run on 450-ft. level to get under ore exposed in old Wheeler lease.

BLUE BULL (Goldfield)—Drifting on veins encountered during past year's development has yielded encouraging assays but no ore in commercial quantity. Placing larger pump and water column at main shaft completed and driving east crosscut 700-ft. level resumed.

Humboldt County

HUMBOLDT COUNTY TUNGSTEN (Lovelock)—Expect new mill at Toulon in operation by Nov. 7, 90 days from construction start.

ROCHESTER MINES (Rochester)—Stated 6-ft. $50 ore recently encountered north end old Four J workings. Expect to start construction work on aërial tram early in November.

ADELAIDE MINE (Golconda)—Property recently taken over by Yerington Mountain Copper Co. Shipping car per week averaging about 5% copper; expect to increase shipments in near future.

Lincoln County

GROOM MINE (Pioche)—Now hauling to Indian Springs station with caterpillar tractor and trailers. Initial trip 23 tons. Expect to haul 35 tons with six trailers.

Mineral County

NEVADA CHAMPION COPPER (Luning)—Plans completed for construction of leaching plant by Charles P. McColm, vice-president, and John C. Skuse, consulting engineer, at Reno office. Holdings include 320 acres formerly known as

Parrot mine; owned for past five months during which reported shipped $45,000 worth ore paying for mine from proceeds.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 21 was 9,864 tons valued at $193,492, compared with 8,855 for week previous. Producers were: Tonopah Belmont, 2,843 tons; Tonopah Extension, 2,380; Tonopah Mining, 2,100; Jim Butler, 1,150; West End, 731; Rescue-Eula, 241; Halifax, 157; North Star, 50; miscellaneous leases, 212 tons.

JIM BUTLER (Tonopah)—September profit was $37,107 from shipment of 3,552 tons to Belmont plant at Millers.

TONOPAH MINING (Tonopah) — September profit $62,770 from treatment of 8,095 tons averaging $17.25 per ton; 150,780 oz. bullion produced valued at $131,595.

TONOPAH BELMONT (Tonopah)—Profit for September was $93,036 from treatment of 11,964 tons ore. Bullion production 2,277.97 oz. gold, and 199,196.33 oz. silver.

TONOPAH DIVIDE (Tonopah)—Control purchased by H. Cal Brougher. Claims lie about 8 mi. south of Tonopah near Goldfield road. Property intermittent producer since early days.

ROUND MOUNTAIN (Round Mountain)—During high water from Mar. 1 to July 1, 142,600 yd. of gravel hydraulicked yielding $48,176, or 33.8c. per yd. Estimated complete cleanup will bring total recovery for block to 50c. per yd. Gravel estimated $2.60 per yd. being hauled to sluices with teams and scrapers.

Storey County

ANDES (Gold Hill)—Saved 44 cars ore from development on 350 level.

UNION CONSOLIDATED (Virginia)—Extracted from 2,500 level 16 cars ore, averaging $18.43 and 21 cars, averaging $19.85.

OHIO

TRUMBULL STEEL CO. (Youngstown)—Announced contract let for five 100-ton openhearth furnaces, 40-in. blooming mill and bar mill, six sheet mills and two jobbing mills, all to be finished within one year.

SOUTH DAKOTA

Custer County

OLD MIKE (Custer)—Compressor plant being moved to Harr and Foye ground near Pringle. Expected regular mica shipments made to Chicago commencing Nov. 1.

Lawrence County

WASP NO. 2 (Flatiron)—Tungsten mill closed but gold mill running steadily.

GENERAL MERRITT (Galena)—Lessees taking out lead-zinc-silver ore shipped to Globe smeltery, at Denver.

REPUBLIC (Maitland)—Burns & Sanford, lessees, have added night shift to crew. Mine product shipped to Trojan mill.

MONARCH (Deadwood) — Lessees extracting satisfactory tonnage of $60 to $75 gold ore and piling milling-grade on dump.

NEW PURITAN (Deadwood)—Drifting at 160 ft. depth to intersect high-grade now in progress. Before starting milling new electric hoist will be installed.

CUSTER PEAK (Roubaix) — Shaft sinking started. Depth of 500 ft. will be attained before lateral work undertaken. Good copper prospects found at 250 ft.

ELK MOUNTAIN (Trojan)—Plant treating nearly 100 tons daily and leasers well satisfied with returns. Large orebody opened up and continued operations assured.

TWO JOHNS (Trojan)—Lessees have had electric power line constructed from Reliance mill substation to portal of tunnel. Power used to drive compressor and hoist.

Pennington County

HILL CITY PRODUCERS (Hill City)—Plant in operation on tin ore from Cowboy and adjoining leases. Tungsten ores will also be concentrated.

NEW GOLDEN WEST (Rochford)—Crosscut tunnel penetrated 177 ft. vein matter, a tremolite characteristic of surface ores. Drift started southerly, near footwall, and vein will be crosscut 150 ft. south of present tunnel.

TENNESSEE

Polk County

TENNESSEE COPPER (Copperhill)—Reported in reorganization plans published that over $2,500,000 has been spent since Jan. 1, 1915, for improvements and new construction exclusive of trinitrotoluol plant expenditures. Construction now largely completed.

UTAH

Beaver County

COMMONWEALTH (Milford)—Five feet ore carrying copper opened in drift north from Andes tunnel. Property adjoins Moscow on south. G. S. Wilkin, superintendent.

CREOLE (Milford)—Lessees working property during past season made good production. Company since reorganized and to be worked on company account. Larger force to be used. J. M. Reynolds, manager.

ANTELOPE STAR (Milford)—Iron and manganese carrying small amount lead opened in winze below tunnel level. Old shaft being cleaned out, will be carefully examined with view to continuing development.

UTAH LEASING (Newhouse)—Company handling large dump of Cactus tailings, treating between 625 and 650 tons daily will increase production within next month to 700 tons. Satisfactory saving made.

MOSCOW (Milford)—Zinc ore being shipped is coming from surface workings and levels extending as far down as 700. Three lots of 100 tons each shipped, averaging from 30 to 33%, since beginning shipments of ore of this character.

Juab County

SHIPMENTS for the week ended Oct. 20 amounted to 204 cars, compared with 197 cars in week preceding. Larger shipments of low-grade siliceous ores are received by smelteries, with resulting greater activity in Tintic section.

TINTIC STANDARD (Eureka)—Eight teams hauling ore—output about 30 tons daily. New shaft to be sunk to 1,300 level at point 1,700 ft. northeast of old shaft. E. J. Raddatz, manager.

MAMMOTH (Mammoth)—Production in neighborhood of 15 cars weekly, ore coming from 400, 600, and from as far down as 1,500 level. September shipments, 59 cars; 130 men employed and production being increased.

LEHI-TINTIC (Eureka)—New four drill compressor in successful operation. Electricity obtained from Utah Power and Light line at 5,000 volts. Two shifts working on lower tunnel, where low-grade silver-lead-iron ore opened.

ETNA (Tintic Junction)—Property in Erickson mining district in west Tintic taken over by Salt Lake men. Capitalization, 500,000 shares, par value 10c., 200,000 shares in treasury. J. H. Manderfield, president. Ore showing galena exposed in old workings.

TINTIC MILLING (Silver City)—Installation of roasters to be completed by Nov. 1, and additions to tanks and leaching department finished shortly after. Expected to have capacity 350 tons a day. September cleanup brought about $18,000. George Dern, general manager.

Salt Lake County

ALTA CONSOLIDATED (Alta)—Two cars lead-silver ore shipped.

SILVER SHIELD (Bingham)—Lessees opened 2 ft. ore running well in lead and silver.

MICHIGAN-UTAH (Alta)—Despaine lease on Solitude tunnel workings shipped 60 tons ore.

COTTONWOOD KING (Salt Lake)—Copper-bearing rock opened by lessees. Vein from 3 to 5 ft. wide. Mine in Big Cottonwood.

EMMA COPPER (Alta)—Shaft from Bay City tunnel unwatered to depth of 35 ft. below 125-ft. level in week's pumping.

KARNS TUNNELING MACHINE (Salt Lake)—Annual metting held recently. J. R. Belcher elected president. Karns machine reported to be working successfully in Montana-Bingham tunnel at Bingham.

LUCKY SIX (Bingham)—Recently organized in Salt Lake to operate claims adjoining Utah Apex, Jay Gould, Alamo, and Quinn properties. New tunnel from Cottonwood Gulch in 150 ft. Fissure cut carrying copper.

OLD EMMA LEASING (Alta)—Incorporated recently with capitalization, $200,000. Organized by G. G. Rice and associates to take over 13 months lease on Old Emma at Alta. Incorporators are: N. P. Caffie, H. T. Farrow, C. M. Egner and T. L. Mitchell.

UNITED STATES SMELTING, R. & M. (Salt Lake)—Earnings for September fortnight and first half October running about 100% ahead of July and August, at rate of $800,000 and $900,000 per month as compared to about $400,000 monthly in the two summer months.

MIDVALE MINERALS (Midvale)—Mill recently erected to treat tailings from old United States wet concentrator has begun operating. Flotation used. Two cars lead-zinc concentrates shipped recently. George Sheldon, president; G. D. Hansen, vice-president and general manager.

CARDIFF (Salt Lake)—Arrangements made for winter work. In addition to modern boarding house, built separate bunk houses for each shift, so one set miners will not disturb another. Production kept at about 100 tons daily despite haulage difficulties. Ore hauled by motor trucks and teams. Mine in Big Cottonwood.

Summit County

PARK CITY shipments for the week ended Oct. 20 amounted to 2,295,320 lb. by five shippers, stormy weather being responsible for smaller shipments than previous week.

NEW QUINCY (Park City)—Ore in western workings widened out to 3 ft., and is making out into bedding of limestone.

SILVER KING CONSOLIDATED (Park City)—New tunnel in 600 ft., and daily progress of 8 ft. being made. New tramway sufficiently completed for hauling coal to mine, but ore not hauled yet. Remodelled 50-ton mill nearly ready for use.

Utah County

PACIFIC GOLD (American Fork)—New 60-ton concentrator expected operating Nov. 1 to handle lead-silver and silver-copper low-grade. Electric power line construction proceeding rapidly.

WISCONSIN

SUPERIOR—Effort will be made to have legislature pass tonnage tax on iron ore. Bill calls for 10c. a ton, with additional charge of 2c. per ton on ore shipped through Ashland and Superior. This would give Superior about $400,000 a year and Ashland about $100,000. It is believed state lacks power to tax ore in transit and fight will be made against passage. Bill will be introduced by Senator F. A. Baxter, of Superior. Tonnage tax which was passed several years ago in Minnesota was vetoed by governor. He maintained legislature did not have power to levy both ad valorem and specific taxes on same property.

WYOMING

Park County

MIDWEST SULPHUR (Cody)—Reported discovery sulphur cave confirmed. Estimated 75 to 100 tons pure sulphur in sight. Real value of find thought to be in chance of connecting with other caves.

CANADA

British Columbia

FLORENCE SILVER (Ainsworth)—New 300-ton concentrator expected finished 60 days.

Ontario

ORE SHIPMENTS OVER THE T. & N. O. RY. for September, 1916, were: From Cobalt, Beaver, 35 tons; Coniagas, 79; Cobalt Comet, 31; Crown Reserve, 46; Hudson Bay, 30; Kerr Lake, 47; La Rose, 91; Mining Corporation of Canada, 38; McKinley-Darragh, 130; Nipissing, 615; O'Brien, 33; Penn. Canadian, 83; Right-of-Way, 20; Temiskaming, 41; Trethewey, 44 tons; total, 1,368 tons. From New Liskeard, Casey Cobalt 27 tons. From Elk Lake, Miller-Lake-O'Brien, 20 tons. Total silver ore shipments, 1,415 tons. From Porquis Junction, Alex (nickel), 384 tons.

PLATT (Porcupine)—Under option to Coniagas, reports satisfactory development.

ADANAC (Cobalt) — Raise completed; shaft down 325 ft. will be sunk 100 ft. further.

COBALT LAKE (Cobalt)—Taking out practically pure silver from new discovery in fault.

CROWN RESERVE (Cobalt)—Struck 3-in. vein on 250-ft. level stated to carry about 2,500 oz. silver per ton.

WRIGHT-HARGRAVES (Kirkland Lake)—Vein 10 ft. wide found on surface reported to assay $50 per ton.

NIPISSING (Cobalt)—Recently made two important discoveries, one in vicinity of Meyer shaft, other in Cobalt Lake fault.

MAIDENS MACDONALD (Porcupine)—Underground work stopped pending installation of plant. Property under option to La Rose.

DOME (Porcupine)—New main working shaft in operation. Despite reports to contrary, open cuts will be operated throughout winter.

LAKE SHORE (Kirkland Lake)—Construction 50-ton mill postponed. Mine developed to 300-ft. level with fair grade ore continuously.

CALUMET & MONTANA (Cobalt)—Promising vein cut in east drift at 60-ft. level. At 90-ft. level, 210 ft. crosscutting done toward vein extension of Nova Scotia.

TOUGH OAKES (Kirkland Lake)—Action to decide legality of present board of directors to be taken in Haileybury soon. Profits for last quarter practically twice dividend requirements.

PORCUPINE CROWN (Timmins) — Diamond drilling being done on 500-ft. level to pick up vein running in from Dominion. Large ore tonnage being blocked out on 900-ft. level.

DOME LAKE (Porcupine)—Mill will be completed in week. When running may make expenses but cannot be expected to do much more. Reported that stock market is manipulated and company should be viewed with considerable suspicion.

HAMILTON MOLYBDENUM ALLOYS (Norland)—No. 2 mine in Halburton County will be developed on large scale. James Harrison, managing director, superintending machinery installation. Reported refinery will be erected.

McKANE (Kirkland Lake)—Shaft sunk to 400-ft. level where station being cut. Dump contains 500 tons ore averaging about $10 per ton. Management estimates about $300,000 ore blocked out. A 10-drill compressor being installed and a new boiler will be put in.

HOLLINGER (Porcupine) — Stated to have evolved a double-tray Dorr thickener giving entire satisfaction. Found impossible to so construct former tanks that they would carry weight. New tanks have opening in bottom of top tray and hydrostatic pressure takes care of weight. Found that thickened material in top tray descends into lower tray in form of a cone without disturbing solutions, and possible to take clear solution from bottom section of tank as well as from top section. Capacity of this type practically 100% greater than that of tanks having single trays.

The Market Report

Metal Markets

NEW YORK—Nov. 1

A very large business, estimated at 85,000,000 lb., was done in copper, the market position of which became stronger. Good business was done in lead and zinc, without much change in price, but zinc was stronger.

Copper, Tin, Lead and Zinc

Copper—A very large business was done, sales by producers being estimated at 85,000,000 lb., compared with about 30,000,000 in the previous week. There was a little export business done, but the great bulk was done with domestic manufacturers—both wire drawers and brass makers figuring largely in the market. Indeed, most of the principal manufacturers appear to have been buyers. The major business was for delivery in January, February and March, and was done at first at 27½c., r.t., then at 27¾c., r.t. On Nov. 1, one of the largest sellers raised its asking price. Scarcely any business for November-December delivery was done, supplies being practically unavailable. January copper is also becoming scarcer. Quotations for special deliveries are about as follows: November, 28¾@29c.; December, 28½@28¾c.; January, 28@28¼c.; all regular terms. Early in the week a round lot for January delivery was sold at 28c., r.t., but later that position became stronger, as did all others.

A noteworthy feature of the week was rather large sales for deliveries far ahead in 1917, even to the end of the year. Manufacturers arranged for such supplies by outright purchase and also for deliveries to be settled for at average quotations.

Copper Exports from New York up to Oct. 28 were reported at the Custom House at 24,750 gross tons.

Copper Exports from Baltimore for the week included 4,912,309 lb. copper to Great Britain; 250 tons brass plate and disks to Italy.

Copper Sheets, base price, nominally 37½c. for hot rolled and 38½c. for cold rolled for delivery at mill convenience. Earlier deliveries mainly on toll basis. Wire 32@32½c., nominal.

Tin—This market was rather quiet, spot tin at the opening was 42c., and at the close, 41⅞c. Futures were 41½c., at the opening, and 41c. at the close.

Lead—A good business was done at unchanged prices. Canada continued to be a buyer, but otherwise, no special export business was reported.

Spelter—A fair volume of business in common spelter was done, there being buying from miscellaneous quarters, including more or less by speculators, but not much demand from galvanizers. The demand was chiefly for early deliveries, producers finding it difficult to place as much as they would like for forward delivery. A large business was done in brass special at about 10½c., this being for metal guaranteed 99.4% zinc. It is noteworthy that the differential between prices for common spelter and brass special has now contracted to what is only a little more than has often prevailed in normal times. A similar contraction in the differential between common spelter and high-grade is to be noticed. On Oct. 26 a lot of 878,000 lb. of metal guaranteed 99.9% zinc was publicly offered to the Government at 15c., delivered at Eastern navy yards.

A consumer of spelter offered the interesting explanation that he was buying because zinc shares were going up in Wall St. In Wall St. they said that zinc shares were going up because spelter was rising.

L. Vogelstein & Co. sent the following letter to the trade under date of Oct. 26: "In view of the car shortage condition existing throughout this country and the movement on the part of the various railroad companies to increase the minimum carlot from 50,000 to 60,000 lb. for spelter and presumably for copper and lead, we will in future make sales in 30-ton lots instead of 25 as heretofore. However, we are perfectly willing to sell you 25-ton lots with the understanding that in the event of the railroads charging any additional freight on account of our shipping less than the minimum of 60,000 lb. you will assume this extra freight. We are advising you of this change at this time because the railroads have the right to ask the Interstate Commerce Commission for permission to publish the new minimum carload rate upon giving five days' notice and it lies within the jurisdiction of that Commission to grant such request."

Zinc Sheets—The base price was advanced 1c. on Oct. 26 to $16 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Nov. 1

Aluminum—Demand continues good and supplies small. Quotations are 64½@66c. per lb. for No. 1 ingots, New York.

Antimony—This market remained unchanged at 13@14c. Sellers are firm and it is noteworthy that importers are holding for higher prices.

Quicksilver—Market steady at $80 per flask. San Francisco reports, by telegraph, $75@76, market dull.

Nickel—Market steady and unchanged at 45@50c. per lb. for ordinary forms; with 5c. premium for electrolytic metal.

Exports from Baltimore for the week included 67,591 lb. shot nickel to Liverpool; 31,946 lb. cupronickel to Italy.

Gold, Silver and Platinum

NEW YORK—Nov. 1

Gold—Gold shipments continue to come to New York from Ottawa. The largest consignment received in one day was on Oct. 27, when $15,000,000 arrived in bars. Other large arrivals were reported every day in the week.

Platinum—Market was a little firmer. On Nov. 1 the U. S. Assay Office was reported as selling 600 oz., at about $90.50. We quote $90@91, but some important refiners are asking more.

Silver has advanced ¼d. in the last few days, owing to an improvement in the Eastern Exchanges. China has been buying via San Francisco. As an indication of the increase of circulation of silver in some of the European countries and reduction of volume in their respective treasuries, it is pointed out that silver in Bank of France July 30, 1914, was £25,000,000; Sept. 28, 1916, £13,473,000; in Bank of Germany, Aug. 31, 1914, £4,114,000; Aug. 31, 1916, £1,263,000. No silver coin is held for security of notes of Bank of England.

Mexican Dollars were quoted in New York Oct. 26 and 27 at 51⅞@54⅞c.; Oct. 28 and 30 at 52@55c.; Oct. 31 at 52¼@55¼c.; Nov. 1 at 52½@55½c. Supplies only moderate.

Zinc and Lead Ore Markets

Platteville, Wis., Oct. 28—Quotations of the district are, according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $65 for premium ore down to $63 for medium grades. For material assaying 80% lead ore the base price per 2,000-lb. ton is $80@82. Shipments for the week were 2,804 tons of zinc ore, 70 tons of lead ore, and 925 tons of sulphur ore. For the year to date, the figures are 106,726 tons of zinc ore, 3,648 tons of lead ore, and 26,206 tons of sulphur ore. Shipped during the week to separating plants, 2,901 tons of zinc ore.

Joplin, Mo., Oct. 28—Price quotations per 2,000 lb.: Blende, high, $77.40, 60% zinc, premium ore, $75.50; medium grades, $74@70; low, $68. Calamine, per ton, 40% zinc, $45@38. Average selling price, all grades of zinc, $62.48 per ton, lower on account of heavy calamine shipment. Lead, high prices, $87; base, $87@80. Average selling price, all grades of lead, $82.47 per ton. Shipments of the week: Blende, 7,542 tons; calamine, 1,085 tons; lead, 1,300 tons. Value, all ores the week, $647,250; ten months, $30,733,610.

Final merger of Granby into American Zinc has been locally effected, ending with the month the existence of Granby as a separate entity. With the last five weeks of Granby existence, 5,000 tons of ore were purchased under that name, and it was purchased before the advances brought the market up to the present level—was what is termed a "good buy."

The local electrical company has restricted the use of 5,000 hp. on account of the low water stage in the streams from which power is derived, and lack of water for concentration, and an unusual shortage of coal cars is working against an increase in ore production. It is estimated by some to have lowered production 15%. Heavy shipments of calamine were made and heavy shipments will be made next week, practically wiping out the surplus of this grade of ore.

Other Ores

Manganese Ore is still quoted at 70@75c. per unit at Tidewater, for Indian and Brazilian ore.

British Imports of Manganese Ore, nine months ended Sept. 30, were 209,814 gross tons in 1915, and 348,394 in 1916; increase, 138,580 tons.

Pyrites Imports in Great Britain, nine months ended Sept. 30, were 659,695 tons in 1915, and 764,210 tons in 1916; increase, 104,515 tons.

Molybdenite—Charles Hardy reports as follows: "The position of molybdenite becomes more and more interesting on account of the increasing demand, and the new buyers of the ore who have appeared of late in this market. Contracts for ferromolybdenum have been closed to cover the

SILVER AND STERLING EXCHANGE

Oct.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Oct. Nov.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
26	4.7569	67⅛	32⅛	30	4.7569	67⅛	32⅛
27	4.7569	67⅛	32⅛	31	4.7569	68⅛	32⅛
28	4.7569	67⅛	32⅛	1	4.7569	68⅛	32⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Oct. Nov.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
26	27 @27¼	42	7.00	6.90 @6.92½	9.87½ @10.00
27	27 @27¼	42	7.00	6.90 @6.92½	9.87½ @10.00
28	27 @27¼	42	7.00	6.90 @6.92½	9.87½ @10.00
30	27 @27¼	42	7.00	6.90 @6.92½	9.87½ @10.00
31	27 @27¼	41.90	7.00	6.90 @6.92½	10.00 @10.25
1	27 @27¼	41¼	7.00	6.90 @6.92½	10 00 @10.25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Oct. Nov.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
26	124½	119½	144	182½	183½	30½	54
27	124½	119½	143	181½	182½	30½	54½
28	...	...	...	...	...	...	...
30	125	120	143	181½	183	30½	53½
31	124	119½	142½	180½	182	30½	52½
1	124	119½	142½	180½	181½	30½	52½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½ cents.

whole of 1917, and if an adequate supply of ore can be guaranteed, a further very large quantity could be booked far ahead into 1917. Ferromolybdenum has changed hands during this week at $4 per lb. of molybdenum contained. The ore remains at the nominal price of $1.70@1.80 per lb. MoS_2."

Tungsten Ore—A rather large business was done at $16@17, the lower price for ordinary material, and the higher price for the better grade.

Charles Hardy, under date of Oct. 31, reports as follows: "The business during October has been on a very large scale and the stocks in New York and Pittsburgh have been reduced considerably. As a consequence, some of the largest interests have advanced their prices to $18, and though no business has as yet been done at that figure, which came into force on Oct. 30, the prospects are that before long that price will be readily paid. I understand that snow interferes already with the production in the West to some extent, and as practically all the tungsten now afloat from abroad has been sold prior to its arrival, there is little fear that the quantities which are expected during this and the coming week will depress our market. The inquiry from abroad for ore and ferro continues and again several contracts have been closed for shipment."

Iron Trade Review

NEW YORK—Nov. 1

The statement of the Steel Corporation on another page shows the great expansion of the steel trade during the present year in a striking way.

The main point in the present week is the runaway market in pig iron. All sorts of advances are now asked, and buyers seem to be more anxious about securing the metal they want than about the prices they pay for it.

It is anounced that J. L. Replogle of the Vanadium Steel Co. has arranged to buy from the Wharton Estate the stock of the Wharton Steel Co The property covered includes extensive holdings of iron ore property in New Jersey, coal lands in Pennsylvania and Ohoi and some blast furnace capacity.

PITTSBURGH—Oct. 31

An unprecedentedly sharp rise has occurred in pig iron, bessemer, basic and foundry being up $2 a ton in the week, with some sellers quoting further advances. Billets and sheet bars are quotably higher after two months of practically stationary prices. Finished steel prices are distinctly higher in many instances, but market prices are not quotable as sharply as formerly as mills are reserved about selling and frequently quote different prices on orders that would usually be regarded as of equal acceptability.

The whole steel market is in the throes of another general and large advance, apparently, similar to that which occurred in the first three months of this year. The mills realize that the market is in a dangerous position, on account of the high prices, but that has been the case since early in the year.

Outputs in October have been very large at all the mills, and the majority have broken their best month's record. Car shortages this week are the worst yet experienced and are curtailing shipments.

Pig Iron—Sales of fair-sized tonnages of bessemer, basic and foundry iron have been made at $2 a ton above minimum quotations of a week ago and the market is higher by that amount, with some sellers asking further advances. We quote: Bessemer, $26@27; basic, $22@23; foundry and malleable, $23@24; forge, $22.50@23, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Snyder October Valley averages bessemer, $23.6576, basic, $20.3086; average foundry, $20.56.

Steel—The whole trade, merchants and consumers, has been thoroughly canvassed of late for soft steel billets and sheet bars, and everything below $50 for billets and $52 for sheet bars has been absorbed, so that the market is quotable at these prices as minimum.

Ferroalloys

Exports of spiegeleisen, ferromanganese and ferrosilicon from Great Britain, nine months ended Sept. 30, were 73,284 gross tons in 1915, and 99,206 tons in 1916; increase, 25,922 tons.

Imports at Baltimore for the week included 1,982 tons ferromanganese from Great Britain.

Ferrosilicon is quoted at $98@100 per ton for 50%. Bessemer ferrosilicon is from $33 for 10% up to $43 for 16%, at furnace.

Spiegeleisen is higher, 20% being quoted at $45@50 per ton at furnace.

Ferromanganese—Sellers are now quite firm at $164 for imported and $165 for domestic on contract, bids at lower prices being turned down. There is a fair demand.

Foreign Iron

German Steel Production in August is reported by the German Iron and Steel Union at 1,412,326 metric tons. For the eight months ended Aug. 31 the make was: Converter, 5,156,847; open-hearth, 4,474,397; direct castings, 706,165; crucible, 72,612; electric, 117,347; total, 10,538,660 tons. This is 2,095,876 tons more than in 1915, but 1,025,602 tons less than in 1914.

STOCK QUOTATIONS

N. Y. EXCH.†	Oct. 31
Alaska Gold M.	12½
Alaska Juneau	7
Am. Sm. & Ref., com.	112
Am. Sm. & Ref., pf.	116½
Am. Sm. Sec., pf. A	99½
Am. Sm. Sec., pf. B	92
Am. Zinc	52⅞
Am. Zinc, pf.	81
Anaconda	95
Batopilas Min.	1½
Bethlehem Steel	640
Bethlehem Steel, pf.	135
Butte & Superior	65½
Chile Cop.	23
Chino	61
Colo. Fuel & Iron	52⅞
Crucible Steel	89½
Dome Mines	24½
Federal M. & S.	16
Federal M. & S., pf.	42
Great Nor., ore ctf.	43½
Greene Cananea	51½
Homestake	130
Inspiration Con.	66⅞
International Nickel	50½
Kennecott	53⅛
Lackawanna Steel	88½
Miami Copper	40½
Nat'l Lead, com.	68½
National Lead, pf.	113½
Nev. Consol.	23⅜
Ontario Min.	6
Quicksilver	2½
Quicksilver, pf.	3½
Ray Con.	26⅛
Republic I. & S., com.	77⅛
Republic I. & S. pf.	114
Sloss-Sheffield	61
Tennessee Copper	23½
U. S. Steel, com.	118⅞
U. S. Steel, pf.	121½
Utah Copper	106½
Va. Iron C. & C.	56½

N. Y. CURB†	Oct. 31
Buffalo Mines	1
Butte & N. Y.	1½
Butte C. & Z.	9
Caledonia	.46
Can. Cop. Corpn.	2⅛
Cashboy	.05
Cerro de Pasco	42
Con. Ariz. Sm.	2½
Con. Coppermines	2⅜
Con. Nev.-Utah	‡.25
Crystal Cop.	.75
First Nat. Cop.	4½
Florence	.70
Goldfield Con.	.58
Goldfield Merger	‡.08
Granite	.40
Hecla Min.	7½
Howe Sound	5½
Jerome Verde	1⅛
Joplin Ore & Spel.	.45
Kerr Lake	4½
Magma	.47
Majestic	.55
McKinley-Dar-Sa.	.58
Mother Lode	.37
Nevada Hills	.18
N. Y. & Hond.	14½
Nipissing Mines	8½
Oro	.04
Ray Hercules	4½
Rochester Mines	.58
St. Joseph Lead	19½
Standard S. L.	1½
Stewart	‡⅛
Success	.36
Tonopah	5½
Tonopah Ex.	5½
Tribullion	.31½
United Zinc	4½
White Knob, pf.	2½
White Oaks	4½
Yukon Gold	2½

SAN FRAN.*	Oct. 31
Alta	.04
Andes	.10
Best & Belcher	.05
Bullion	.01
Caledonia	.30
Challenge Con.	‡.05
Confidence	.10
Cons. Imperial	.01
Con. Virginia	.10
Gould & Curry	.03
Hale & Norcross	.05
Jacket-Cr. Pt.	‡.03
Mexican	.13
Occidental	‡.65
Ophir	.23
Overman	.03
Savage	.10
Seg Belcher	.03
Sierra Nevada	.28
Union Con.	.57
Utah Con.	.01
Belmont	4.25
Jim Butler	.90
MacNamara	.11
Midway	.25
Mont.-Tonopah	.20
North Star	.16
Rescue Eula	.24
West End Con.	.70
Atlanta	.09
Booth	.10
C.O.D. Con.	.03
Comb. Frac.	.05
D'field B.B.	.07
D'field Daisy	‡.05
Jumbo Extension	.33
Round Mountain	.36
Sandstorm Kendall	‡.04
Silver Pick	.18
Central Eureka	‡.05
Argo	.06
Ariz. Central	.10
Big Jim	1.18½
Lazy Boy	.06
Oatman No. Star	‡.14
Tom Reed	2.20
United Eastern	3.90
United Western	.04

BOSTON EXCH.*	Oct. 31
Adventure	3½
Ahmeek	105
Algomah	.99
Allouez	69
Ariz. Com., ctfs.	14
Bonanza	.40
Butte-Ballaklava	2½
Calumet & Ariz.	78½
Calumet & Hecla	575
Centennial	21
Copper Range	70½
Daly West	2½
East Butte	15½
Franklin	8½
Granby	89
Hancock	13½
Helvetia	.25
Indiana	3
Island Cr'k, com.	57
Island Cr'k, pfd.	92½
Isle Royale	33½
Keweenaw	5½
Lake	13½
La Salle	4½
Mason Valley	5
Mass	15½
Mayflower	3
Michigan	4
Mohawk	95
New Arcadian	6
New Idria	13
North Butte	21½
North Lake	1½
Ojibway	1½
Old Colony	1½
Old Dominion	72
Osceola	91
Quincy	91½
St. Mary's M. L.	88
Santa Fe	2½
Shannon	9
Shattuck-Ariz.	29
So. Lake	5½
So. Utah	.25
Superior	15½
Superior & Bost.	8⅛
Tamarack	44
Trinity	6½
Tuolumne	.69
U. S. Smelting	70½
U. S. Smelt'g, pf.	50½
Utah Apex	3½
Utah Con.	14½
Utah Metal	6½
Victoria	6
Winona	4½
Wolverine	44
Wyandot	1½

BOSTON CURB*	Oct. 31
Alaska Mines Corp.	.85
Bingham Mines	9½
Boston Ely	.65
Boston & Mont.	.80
Butte & Lon'n Dev.	.53
Calaveras	5½
Calumet-Corbin	.02½
Chief Con.	2
Cortez	.30
Crown Reserve	.45
Davis-Daly	3⅛
Eagle & Blue Bell	1½
Houghton Copper	1½
Iron Cap Cop., pf.	5½
Mexican Metals	.48
Mines of America	2½
Mojave Tungsten	3½
Nat. Zinc & Lead	.55
Nevada-Douglas	1⅛
New Baltic	2½
New Cornelia	17½
Ohio Copper	.25
Oneco	.80
Rex Cons.	.29
Rilla	.11
United Verde Ext.	39½

SALT LAKE*	Oct. 31
Big Four	1.10
Black Jack	.07
Cardiff	6.90
Colorado Mining	.18
Crown Point	.05½
Daly-Judge	8.00
Emma Cop.	2.50
Gold Chain	.10
Grand Central	.60
Iron Blossom	1.65
Lower Mammoth	.05
May Day	.12½
Opohongo	‡.01½
Prince Con.	1.32½
Seven Troughs	‡.03
Silver-King Coal'n.	2.90
Silver King Con.	3.70
Sioux Con.	.15½
So. Hecla	1.75
Uncle Sam	.06
Wilbert	.09½
Yankee	.16

TORONTO*	Oct. 31
Bailey	.07½
Beaver Con.	.39
Chambers Ferland	.11
Conisgas	4.75
La Rose	.55
Peterson Lake	.18
Right of Way	.05
Seneca Superior	.09
T. & Hudson Bay	73.00
Temiskaming	.59
Wettlaufer-Lor.	.10
Dome Exten.	.30
Dome Lake	.53
Foley O'Brien	.70
Hollinger	6.65
Jupiter	.26
McIntyre	1.65
Newray	.76
Porcu. Crown	.72
Vipond	.35
West Dome	.28½

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Oct. 31
Doctor Jack Pot	.09
Elkton Con.	.10
El Paso	.40
Findlay	.03
Gold Sovereign	.04½
Golden Cycle	2.43
Granite	.67
Isabella	.22½
Jack Pot	‡.05
Mary McKinney	.32
Portland	1.93
Vindicator	1.75½

LONDON	Oct. 16
Alaska Mexican	£0 15s0d
Alaska Tre'dwell	3 0 0
Burma Corp.	4 6 3
Cam & Motor	0 11 6
Camp Bird	0 7 6
El Oro	0 8 9
Esperanza	0 11 0
Mexico Mines	3 17 6
Nechi, pfd.	0 13 6
Oroville	0 16 6
Santa Gert'dis	0 11 3
Tomboy	1 1 0

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	67.855	23.199	23.925	32.361
November	49.082	51.714	.....	22.703	25.094	.....
Dec.	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	26.855	68.915	113.905	85.250	134.071
Oct.	17.686	27.193	72.601	122.750	88.000	142.523
Nov	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.430	.....
Year	17.275	.....	72.532	.....	.....	.....

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	199.132	199.699
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224	.....	167.670	.....
December	38.779	.....	167.000	.....
Av. year	38.590	.....	163.960	.....

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600	7.000	4.499	6.898	23.994	30.716
November	5.155	.....	5.078	.....	26.278	.....
December	5.355	.....	5.266	.....	28.807	.....
Year	4.673	.....	4.567	.....	22.917	.....

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	8.730	12.611	8.560	67.786	51.587
Sept.	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.800	9.829	12.596	9.659	66.536	54.159
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	22.88	15.95	19.58	15.70	19.53
October	16.95	24.61	15.96	21.26	15.80	21.51
November	17.57	.....	16.47	.....	17.20	.....
December	19.97	.....	18.44	.....	18.95	.....
Year	$15.82	.....	$14.76	.....	$14.95	.....

‡ As reported by W. P. Snyder & Co.

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

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